Aviation Communication and Surveillance Systems

NGT-2500 FCC COMPLIANCE PLAN AND RESULTS

CAGE Code	Initial Release Date	Revision Date	Document Number	Revision
1WYD3	**01-Oct-2014**	**N/A**	**8021005-001**	**-**

Record of Revisions

Rev	Date	Authorization	Description of Change
-	01-Oct-2014	ECR015419	Initial Release

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1 INTRODUCTION

The NGT-2500 is an Automatic Dependent Surveillance-Broadcast (ADSB) transceiver with a built-in GPS receiver. The equipment provides ADSB out functionality over Universal Access Transceiver (UAT) link, Enhanced Visual Acquisition (EVAcq) using traffic information from ADS-B In received via a UAT link, Flight Information Service – Broadcast (FIS-B) using received data via UAT link and Wireless interception of the Mode A squawk Code from the aircraft's existing Air Traffic Control Radar Beacon System (ATCRBS) transponder or through a dedicated MODE A control panel interface.

The GPS-UAT equipment is designed to operate with +14V or +28V VDC power supply

1.1 Purpose

The purpose is to provide the FCC compliance plan and test results for the NGT-2500 equipment

1.2 Scope

This test results document establishes the FCC compliance plan and procedures for NGT-2500, Part Number 9022500-10000

1.3 References

Table 1-1 Referenced ACSS Documents

Document No.	Revision	Description
9022500-10	F	Hardware Assembly Drawing
9022500-10000	B	Assembly, Hardware End item
9022010-002	B	CCA Drawing (GPS-UAT CCA)
9021030-001	E	CCA Drawing (Power Supply CCA)
9021020-001	F	CCA Drawing (Power Amplifier CCA)
9022501-001	B	Outline and Installation Drawing
0040-17011-01	-	Installation Manual

Table 1-2 Referenced Industry Documents

Source	Document No.	Revision	Description
FAA	AC-20-172A	03/23/2012	Airworthiness Approval for ADS-B In Systems and Applications
FAA	AC 20-165A	11/07/2012	Airworthiness Approval of Automatic Dependent Surveillance – Broadcast (ADS-B) Out Systems

Table 1-2 Referenced Industry Documents

Source	Document No.	Revision	Description
FAA	TSO-C145c	05/02/2008	Airborne Navigation Sensors Using The Global Positioning System Augmented By The Satellite Based Augmentation System
FAA	TSO-C154c	12/02/2009	Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz
FAA	TSO-C157a	09/09/2011	Aircraft Flight Information Services – Broadcast (FIS-B) Data Link Systems and Equipment
FAA	TSO-C195a	02/29/2012	Avionics Supporting Automatic Dependent Surveillance – Broadcast (ADS-B) Aircraft Surveillance Applications (ASA)
RTCA	DO-160G	12/08/2010	Environmental Conditions and Test Procedures For Airborne Equipment
RTCA	DO-229D with Change 1	12/13/2006 02/01/2013	Minimum Operational Performance Standards for Global Positioning System/Satellite-Based Augmentation System Airborne Equipment
RTCA	DO-267A	04/29/2004	Minimum Aviation System Performance Standards (MASPS) for Flight Information Services-Broadcast (FIS-B) Data Link
RTCA	DO-282B with Corrigendum 1	12/02/2009 12/13/2011	Minimum Operational Performance Standards (MOPS) for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B)
RTCA	DO-317A	12/13/2011	Minimum Operational Performance Standards (MOPS) for Aircraft Surveillance Applications (ASA) System

Table 1-3: Referenced FCC Documents

Document No.	Description
CFR Title 47 Chapter 1 Part 2 Subpart J	Code of Federal Regulations – Telecommunications Federal Communications Commission Frequency Allocations and Radio Treaty Matters; General Rules and Regulations Equipment Authorization Procedures Revised as of October 1, 2001
CFR Title 47 Chapter 1 Part 15 Subpart A	Code of Federal Regulations – Telecommunications Federal Communications Commission Radio Frequency Devices General Revised as of October 1, 2001
CFR Title 47 Chapter 1 Part 87	Code of Federal Regulations, Telecommunication. Part 87 – Aviation Services Revised as of 10/01/1989
PART 87	Code of Federal Regulations, Telecommunication. Part 87 – Aviation Services

1.4 Acronyms and Abbreviations

Table 1-4: Acronyms and Abbreviations

Acronym	Definition
ACSS	Aviation Communication and Surveillance Systems
ADSB	Automatic Dependent Surveillance – Broadcast
ASA	Aircraft Surveillance Applications
ATCRBS	Air Traffic Control Radar Beacon System
ATE	Automated Test Equipment
CCA	Circuit Card Assembly
CFR	Code of Federal Regulations
CPFSK	Continuous Phase Frequency Shift Keying
CRC	Cyclic Redundancy Check
dB	decibel
EVAcq	Enhanced Visual Acquisition
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FET	Field Effect Transistor
FIS-B	Flight Information Service - Broadcast
FPGA	Field Programmable Gate Array
FSK	Frequency Shift Keying
GHz	Giga Hertz
GPS	Global Positioning System
IF	Intermediate Frequency
kHz	kilo Hertz
LDMOS	Laterally Diffused Metal Oxide Semiconductor
LNA	Low Noise amplifier
LO	Local Oscillator
LRU	Line Replaceable Unit

Acronym	Definition
MASPS	Minimum Aviation System Performance Standards
Mbps	Mega bits per second
MHz	Mega Hertz
MOPS	Minimum Operational Performance Standards
ns	nanosecond
PC	Personal Computer
PLL	Phase Locked Loop
PPM	Parts Per Million
RF	Radio Frequency
rms	root mean square
RTCA	Radio Technical Commission for Aeronautics
TCXO	Temperature Compensated Crystal Oscillator
TSO	Technical Standard Order
UAT	Universal Access Transceiver
us	microsecond
UUT	Unit Under Test
VCO	Voltage Controlled Oscillator
VDC	Volts Direct Current

2 GENERAL INFORMATION

2.1 Type Designation

The equipment has been designated by ACSS as NGT-2500, P/N 9022500-10000.

2.2 Service and Rule for Intended Operation

Air Traffic Control
Part 87, Subpart A

2.3 Description of Equipment

2.3.1 NGT-2500 Functionality

The NGT-2500 is an Automatic Dependent Surveillance-Broadcast (ADSB) transceiver with a built-in GPS receiver. The equipment provides ADSB out functionality over Universal Access Transceiver (UAT) link, Enhanced Visual Acquisition (EVAcq) using traffic information from ADS-B In received via a UAT link, Flight Information Service – Broadcast (FIS-B) using received data via UAT link and Wireless interception of the Mode A squawk Code from the aircraft's existing Air Traffic Control Radar Beacon System (ATCRBS) transponder or through a dedicated MODE A control panel interface. The NGT-2500 will be compliant to the following TSO's:

- TSO-C145c: Airborne Navigation Sensors Using The Global Positioning System Augmented By The Satellite Based Augmentation System
- TSO-C154c: Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz
- TSO-C157a: Aircraft Flight Information Services – Broadcast (FIS-B) Data Link Systems and Equipment
- TSO-C195a: Avionics Supporting Automatic Dependent Surveillance - Broadcast (ADS-B) Aircraft Surveillance Applications (ASA)

2.3.1.1 Type of Emission

UAT Transmission: 1M30F1D
Mode A Interrogation: 18M0P1D

2.3.1.2 Frequency Range

UAT Transmission: 978 MHz ± 19.56 kHz
Mode A Interrogation: 1030 MHz ± 0.1 MHz

2.3.1.3 Power Rating

UAT Transmission: 40 Watts Peak Effective Radiated Power (Pulsed)
Mode A Interrogation: 0.00032 Watts Peak Effective Radiated Power (Pulsed)

2.3.1.4 Final Power Amplifier

The final power amplifier is a 60W LDMOS FET with approximately 14dB of gain.

2.3.1.5 Active Device Functions

Table 2-1: UAT Active Devices

Function	Device Type	Part	Manufacturer
Oscillator	Temperature Compensated Crystal Oscillator (TCXO)	FOX924B-27.000	Fox Electronics
	RF Synthesizer/VCO with integrated RF Mixer	RFFC2071SQ	RFMD
	Integrated Synthesizer and VCO	ADF4360-7BCPZ	Analog Devices
Transmitter	Gain Block, Id = 35mA, 22.4 dB Gain	GALI-3+	Mini Circuits
	Gain Block, Id = 48mA, 19 dB Gain	BL051	BeRex
	High-Linearity LNA Gain Block	TQP3M9035	TriQuint
	2 Watt High Linearity Amplifier	TQP7M9106	TriQuint
	60W LDMOS Amplifier	LET9060	STMicroelectronics
CPFSK Modulator	Digital Data Synthesizer	AD9953YSVZ	Analog Devices

2.3.2 Circuit Diagram

A block diagram and schematics will be provided with the FCC Form 731 when the application for certification is filed with the FCC.

2.3.3 Instruction Book

An ACSS document, Installation Manual (0040-17011-01) provides instructions for the proper installation of the NGT-2500 on a given aircraft.

2.3.4 Tune-up Procedure

No field tuning is required.

2.3.5 Oscillator Circuit

The NGT-2500 uses 907.4 MHz as LO signal for up-conversion and down-conversion of UAT signal. The LO utilizes a TCXO of frequency 27 MHz. Another LO driven by the same 27 MHz TCXO, generates 1030MHz for Mode A Interrogation. A FPGA is used to program both these LO's to produce the required frequencies.

2.3.6 LO Source Circuitry

The LO signal (907.4 MHz) for UAT signal up-conversion and down-conversion is generated in a RF Synthesizer with an integrated VCO and mixer. The generated LO signal is internally buffered and routed to the transmitter mixer and receiver mixer. The VCO core consists of three VCO's and each VCO has 128 overlapping bands, which are used to achieve low VCO gain and optimal phase noise performance across the whole tuning range. The chip automatically selects the correct VCO (VCO auto-select) and VCO band (VCO coarse tuning) to generate the desired LO frequency based on the values programmed into the PLL1 and PLL2 registers banks. The lock detect flag indicates if the LO is locked to the correct frequency. All on-chip are programmed using a proprietary 3-wire serial bus, which supports both write and read operations. Synthesizer programming, device configuration, and control are achieved through a mixture of hardware and software controls.

Another RF synthesizer with integrated VCO generates 1030 MHz for Mode A Interrogation. The center frequency of the RF synthesizer is set by external inductors. All the on-chip registers are controlled by FPGA through a simple 3-wire interface.

2.3.7 Frequency Stabilization

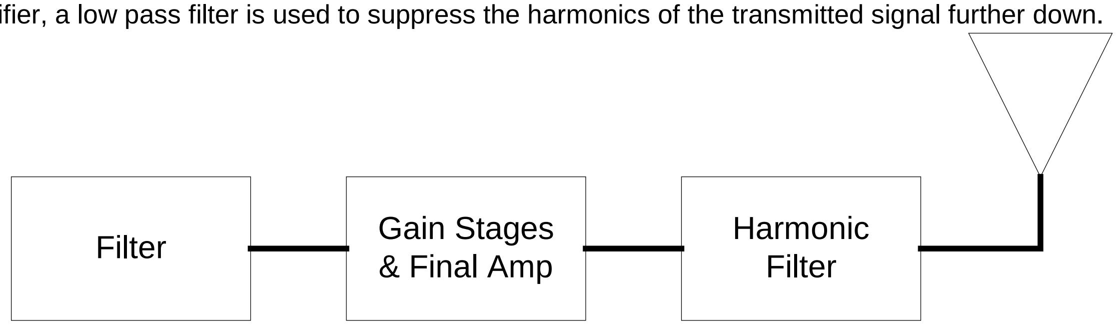
TCXO with stability of ±2.5PPM

2.3.8 Modulation Limiting

Not Applicable

2.3.9 Radiated Interference Suppression

The In-band transmission spectrum of the pulsed signal (978 MHz) is controlled by using an IF filter and by affecting the rise and fall times of the pulsed output of the modulator. Band pass filters are used in between amplifiers to suppress the LO leakage and the harmonic of the transmitted signal. After the final amplifier, a low pass filter is used to suppress the harmonics of the transmitted signal further down.



The spectral output for 978 MHz transmissions will be limited to the following schedule:

Table 2-2 Transmitter Spectral Mask

Frequency difference (MHz from carrier)	Maximum Relative power (dB below maximum)
±0.5	0dBc
±1	18dBc
±2.25	50dBc
±3.25	60dBc

3 MODULATION DETAILS

3.1 UAT Transmission

The nominal modulation rate is 1.041667 megabits per second. The data is modulated onto the carrier using binary Continuous Phase Frequency Shift Keying with a modulation index of 0.6. A binary 1 is indicated by a shift up in frequency from the nominal carrier frequency of $\Delta f/2$ (+312.5 kHz) and a binary 0 by a shift of $-\Delta f/2$ (-312.5 kHz). These frequency deviations apply at the optimum sampling points for the bit interval.

3.2 Mode A Interrogation

Mode A interrogation takes place once in a second after every UAT transmission. Mode A interrogations are pulse amplitude modulated signals (PAM) and consist of P1 and P3 pulses. The pulse characteristics of P1 and P3 pulses are tabulated in Table 3-1

Table 3-1: P1 and P3 Pulse Characteristics

Parameter	Specification
Pulse Duration	0.8 ± 0.05 us
Rise Time	0.1 us maximum
Fall Time	0.2 us maximum
Pulse Spacing, P1 to P3	8.0 ± 0.1 us

Mode A interrogation pulse waveform is as shown in Figure 3-1

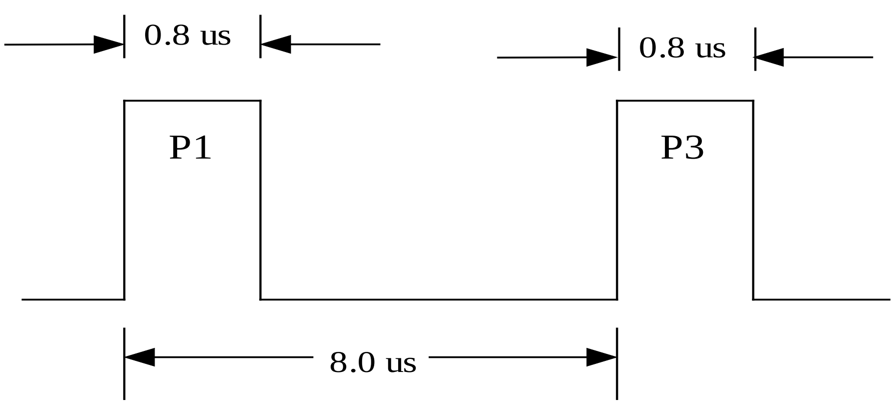


Figure 3-1: Mode A Interrogation Pulse Waveform

4 EQUIPMENT AND SETUP

4.1 Test Equipment

The test equipment used, are listed in each test results section below.

4.1.1 Setup Block Diagram

Setup block diagrams are shown in each test results section below.

4.2 LRU Setup

Figure 4-1: Test Equipment Setup

Figure 4-2: Test Equipment Setup and Temperature Chamber

Figure 4-3: NGT-2500 inside the Temperature Chamber

4.2.1 Hardware Configuration

Testing was conducted on a single NGT-2500 LRU P/N 9022500-10000, S/N Q10020

4.2.2 Software Configuration

The part number and CRC of the software, which was used for testing, are shown in Figure 4-4

BOOT Loader Software Part Number	RL980002-021
BOOT Loader Software Version Number	01
BOOT Loader Software CRC	46,45,34,39,41,43,38,37(0xFE49AC87)
Operational Software Part Number	RL98005-021RL980001-021
Operational Software Version Number	21
Operational Software CRC	45,43,38,30,33,45,43,42(0xEC803ECB)
Firmware Part Number	RL98005-021RL9021120-021
Firmware Version Number	18
Firmware CRC	42,30,34,43,42,38,30,42,(0xB04CB80B)

Figure 4-4: Software Details

5 DRAWINGS AND PHOTOGRAPHS

5.1 Drawings

Refer to Table 1-1 for a list of ACSS drawings that will be furnished with the application.

5.2 Photographs

Photographs of the NGT-2500 unit illustrating the assembly drawings are found in Figure 5-1 through Figure 5-12.

Figure 5-1: NGT-2500 Front View

Figure 5-2: NGT-2500 Rear View

Figure 5-3: NGT-2500 Top View With Top Cover Removed

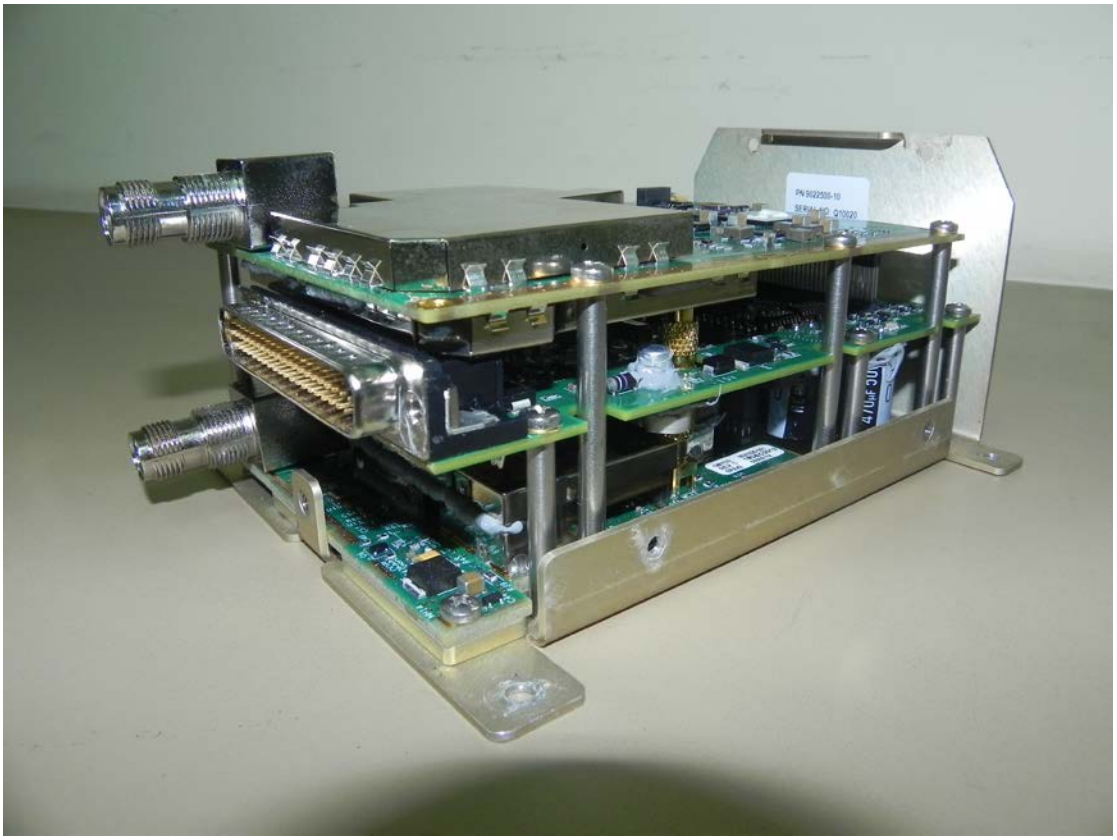


Figure 5-4: NGT-2500 Side View With Top Cover Removed

Figure 5-5: NGT-2500 with GPS-UAT CCA Removed

Figure 5-6: GPS-UAT CCA Top Side

Figure 5-7: GPS-UAT CCA Bottom Side

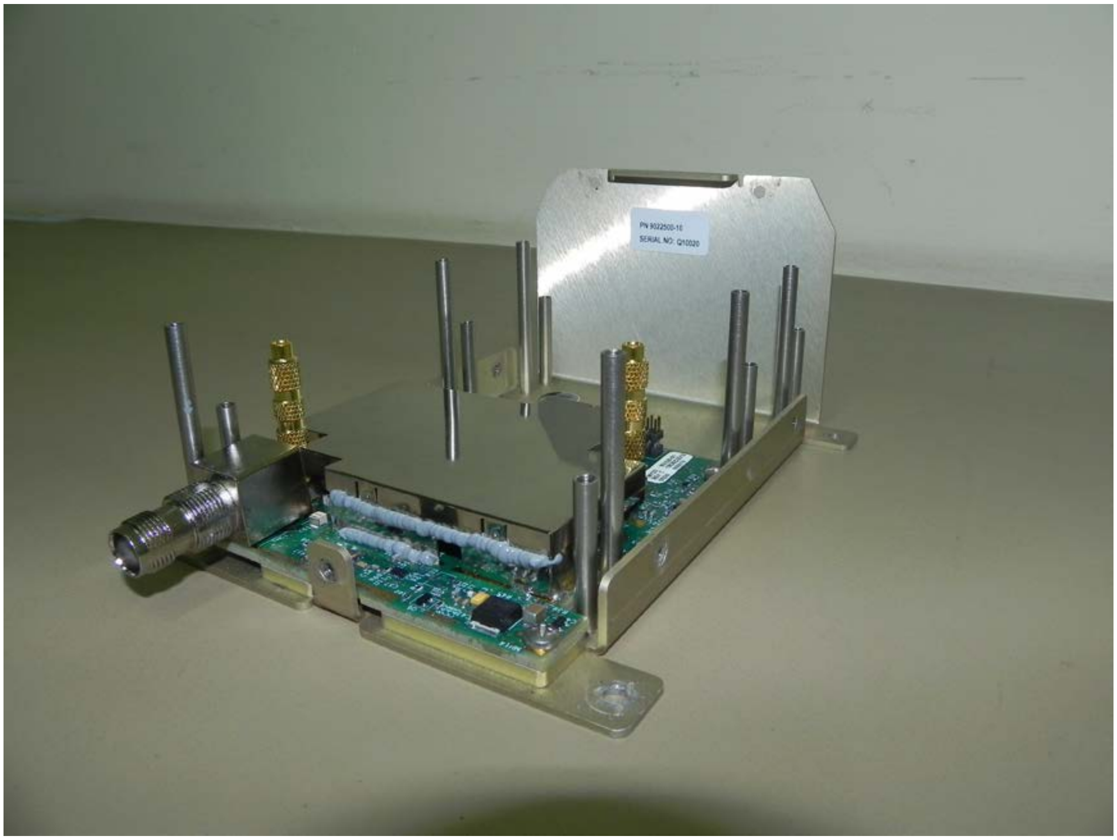


Figure 5-8: NGT-2500 with GPS-UAT CCA and Power Supply CCA Removed

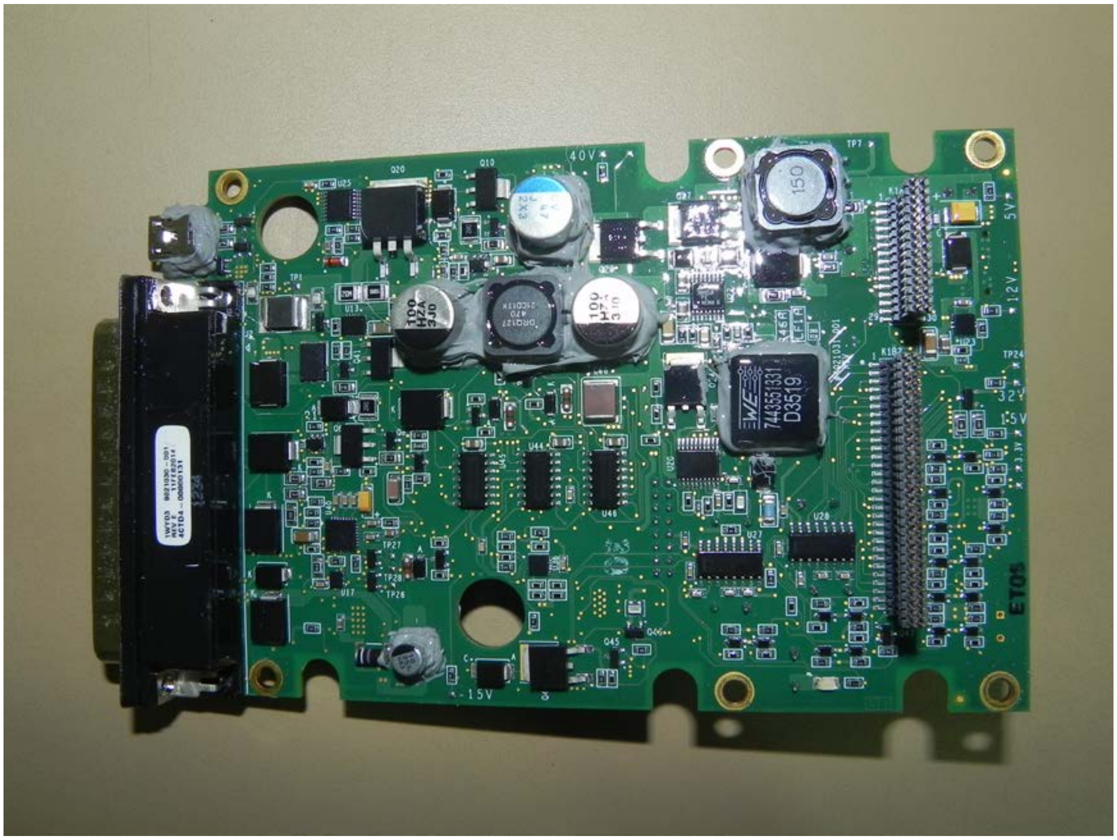


Figure 5-9: Power Supply CCA Top Side

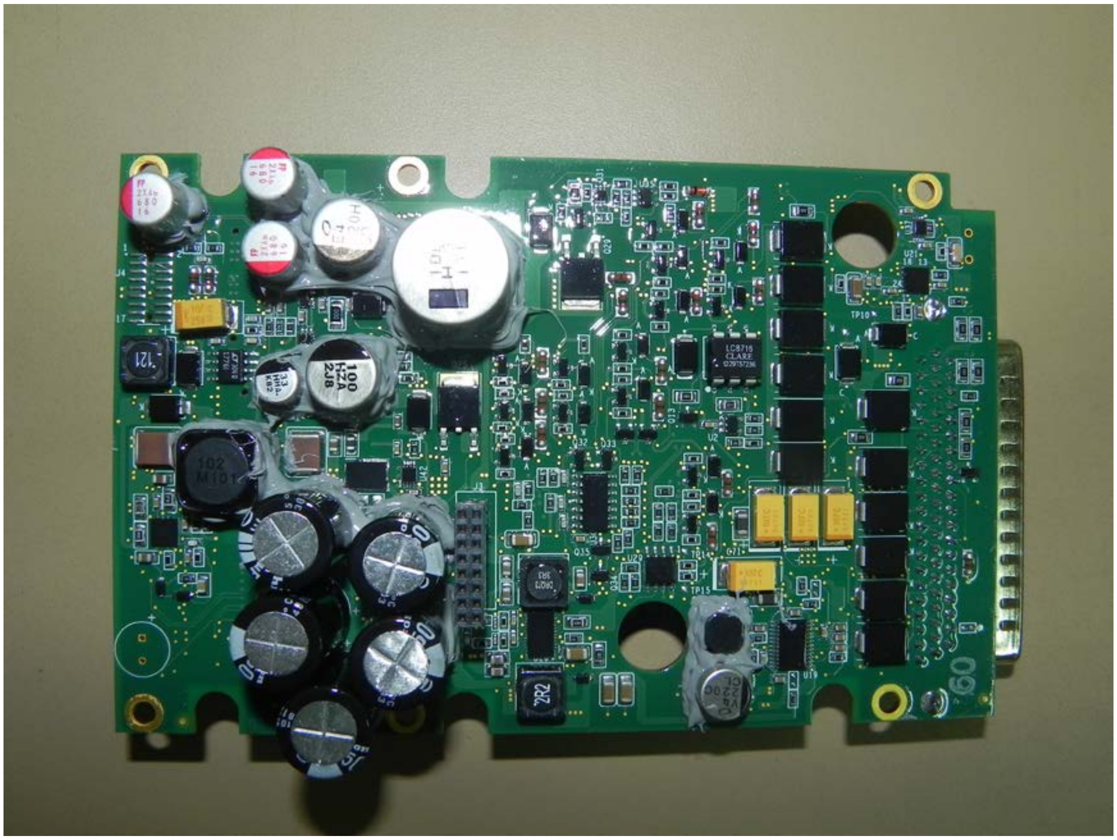


Figure 5-10: Power Supply CCA Bottom Side

Figure 5-11: Power Amplifier CCA Top Side

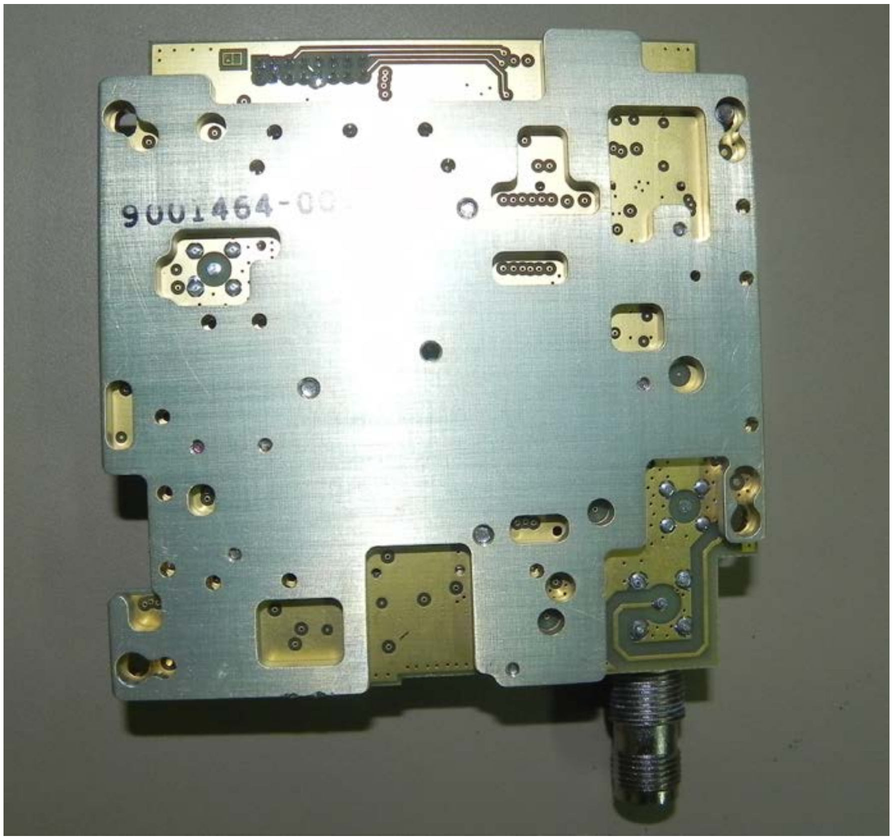


Figure 5-12: Power Amplifier CCA Bottom Side

6 FCC COMPLIANCE TEST PLAN

6.1 FCC Compliance Overview

The Code of Federal Regulations, Title 47, Volume 1, Part 2, Subpart J (47CFR2.xxxx) provides procedures for radio frequency equipment to be authorized by the FCC. Certification is an equipment authorization issued by the commission, based on representations and test data submitted by the applicant. Certification attaches to all units subsequently marketed by the grantee which are identical to the sample tested except for permissive changes or other variations authorized by the commission.

6.1.1 FCC Identifier

47CFR2.924 states that equipment, which has been authorized by the FCC, bears an FCC Identifier. Equipment, which has been authorized, may be marketed under different model/type numbers or trade names without additional authorization from the commission, provided that such devices are electrically identical and the equipment bears an FCC Identifier validated by a grant of equipment authorization.

6.2 NGT-2500 to be subjected to FCC Compliance Testing

The NGT-2500 unit (9022500-10000) will be subjected to the full suite of FCC compliance tests with the resulting data submitted to the FCC for certification. All results will be compiled in the report that follows.

7 TEST FACILITIES

FCC Testing performed at the following FCC Listed and Certified facilities:

DNB Engineering, Inc
Utah Test Facility
1100 Chalk Creek Road
Coalville, UT 84017
United States

8 TEST SCHEDULE

FCC testing will commence in September of 2014.

9 FCC COMPLIANCE TEST PROCEDURES

47CFR2.1041 states that for equipment operating under parts 15 & 18, the measurement procedures are specified in the rules governing the particular device for which certification is requested. For equipment operating in the authorized radio services, measurements are required as specified in sections 2.1046 (RF Power Output), 2.1047 (Modulation Characteristics), 2.1049 (Occupied Bandwidth), 2.1051 (Spurious Emissions at Antenna Terminals), 2.1053 (Field Strength of Spurious Radiation), 2.1055 (Frequency Stability) and 2.1057 (Frequency Spectrum to be Investigated).

9.1 RF Power Output

47CFR Reference:
2.1046, RF Power Output
87.131, Bandwidth of Emission

9.1.1 UAT Transmission

Given that the power output of the UAT transmitter located inside the NGT-2500 unit ranges from 25 W to 63 W at the UAT antenna port of the unit, the UAT transmitter's peak power output in dBm is calculated as follows:

P_{peak_Max} (dBm) = $10Log_{10}$ (1000 x P_{peak_Max} (W) / 1W)
P_{peak_Max} (dBm) = $10Log_{10}$(1000 x 63/ 1W)
P_{peak_Max} (dBm) = +48 dBm

P_{peak_Min} (dBm) = $10Log_{10}$ (1000 x P_{peak_Min} (W) / 1W)
P_{peak_Min} (dBm) = $10Log_{10}$(1000 x 25/ 1W)
P_{peak_Min} (dBm) = +44 dBm

The UAT transmitter's measured peak power output should be within +44dBm and +48dBm at the UAT antenna port, considering manufacturing tolerances, measurement equipment tolerances and losses in any cables/connectors.

Comment: In this report, the LRU's output power may be referenced in two separate locations, at the antenna or at the UAT antenna port of the unit. Maximum installation cable loss considered is 2dB.

9.1.1.1 RF Power Output Test Equipment Required

Table 9-1: RF Power Output Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Variable Attenuator (or Equivalent)	Fairview Microwave	SA35110
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.1.1.2 RF Power Output Test Setup

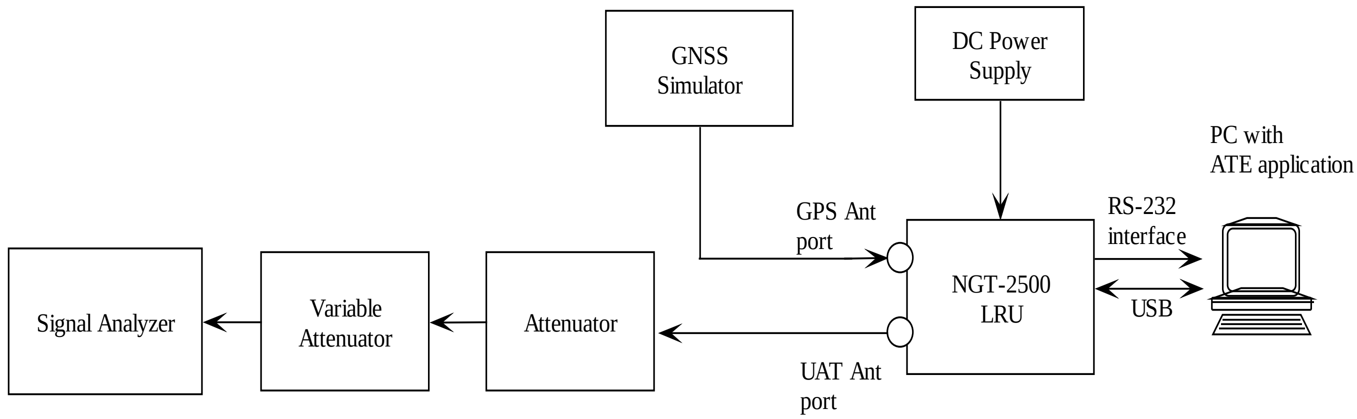


Figure 9-1: RF Power Output Test Setup for UAT transmission

9.1.1.3 RF Power Output Test Procedure

1. Connect the equipment as shown in Figure 9-1 above.
2. Adjust the variable attenuator such that 978MHz signal power level at the input of Signal Analyzer is –6 ± 1dBm (Total attenuation required between UAT antenna port of UUT and Signal Analyzer input: 53dB approx.)
3. Configure the Signal Analyzer as per below settings
   - Center frequency: 978MHz
   - Span: 0Hz
   - Resolution bandwidth: 2MHz
   - Video bandwidth: 6MHz
   - Sweep time: 1ms
   - Trigger type: Video
   - Trigger delay: -250us
   - Trace/Max hold: ON
   - Continuous peak search: ON
   - Reference level offset: Total attenuation between the unit and Signal Analyzer
   - Reference level: +55dBm
4. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel.
5. Record the measured output power on Signal Analyzer.

9.1.1.4 Test Result Data

The peak power measured is mentioned in Table 9-2.

Table 9-2: NGT-2500 Peak power output

NGT-2500 UAT Peak power output		Limit
Measurement	**UAT antenna port**	
Power Output (dBm)	+47.57	+44dBm to +48dBm

9.1.2 Mode A Interrogation

The peak power output calculation in dBm for Mode A Interrogation is as follows:

P_{peak_Max} (dBm) = $10Log_{10}$ (1000 x P_{peak_Max} (W) / 1W)
P_{peak_Max} (dBm) = $10Log_{10}$(1000 x 0.0005/ 1W)
P_{peak_Max} (dBm) = -3 dBm

P_{peak_Min} (dBm) = $10Log_{10}$ (1000 x P_{peak_Min} (W) / 1W)
P_{peak_Min} (dBm) = $10Log_{10}$(1000 x 0.0000158/ 1W)
P_{peak_Min} (dBm) = -18 dBm

9.1.2.1 RF Power Output Test Equipment Required

Table 9-3: RF Power Output Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Circulator	Renaissance Communications Private Limited	A2NN
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Tunable Band Pass Filter (Tuned to 1030MHz)	Telonic Berkeley Inc.	TTF 1000
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.1.2.2 RF Power Output Test Setup

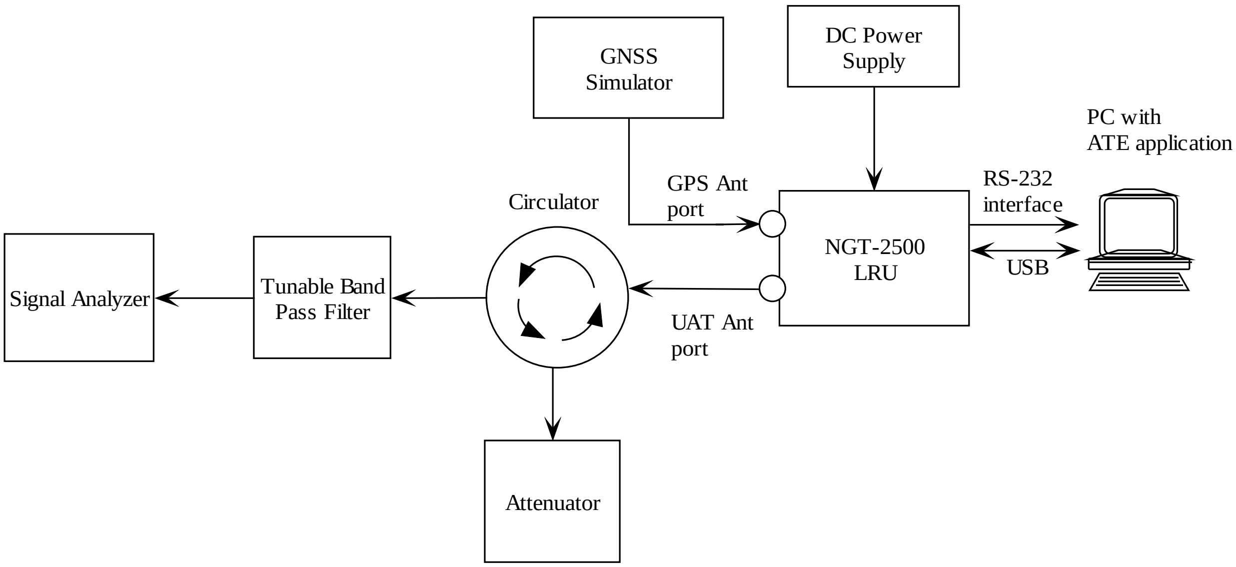


Figure 9-2: RF Power Output Test Setup for Mode A Interrogation

9.1.2.3 RF Power Output Test Procedure

1. Connect the equipment as shown in Figure 9-2.
2. Configure the Signal Analyzer as per below settings
   - Center frequency: 1030MHz
   - Span: 0Hz
   - Resolution bandwidth: 8MHz
   - Video bandwidth: 50MHz
   - Sweep time: 20us
   - Trigger type: Video
   - Trigger delay: -5us
   - Trace/Max hold: ON
   - Continuous peak search: ON
   - Reference level offset: Total attenuation between the unit and Signal Analyzer
3. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel.
4. Record the measured output power on Signal Analyzer.

9.1.2.4 Test Result Data

The peak power measured is mentioned in Table 9-4

Table 9-4: NGT-2500 Peak power output

NGT-2500 Mode A Interrogation Peak power output		Limit
Measurement	UAT antenna port	
Power Output	-15.029 dBm	-3dBm to -18dBm

9.2 Modulation Characteristics

47CFR Reference:
2.1047, Modulation Characteristics
87.141c, Modulation Requirements

9.2.1 UAT Transmission

9.2.1.1 Modulation Characteristics Test Equipment Required

Table 9-5: Modulation Characteristics Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Variable Attenuator (or Equivalent)	Fairview Microwave	SA35110
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.2.1.2 Modulation Characteristics Test Setup

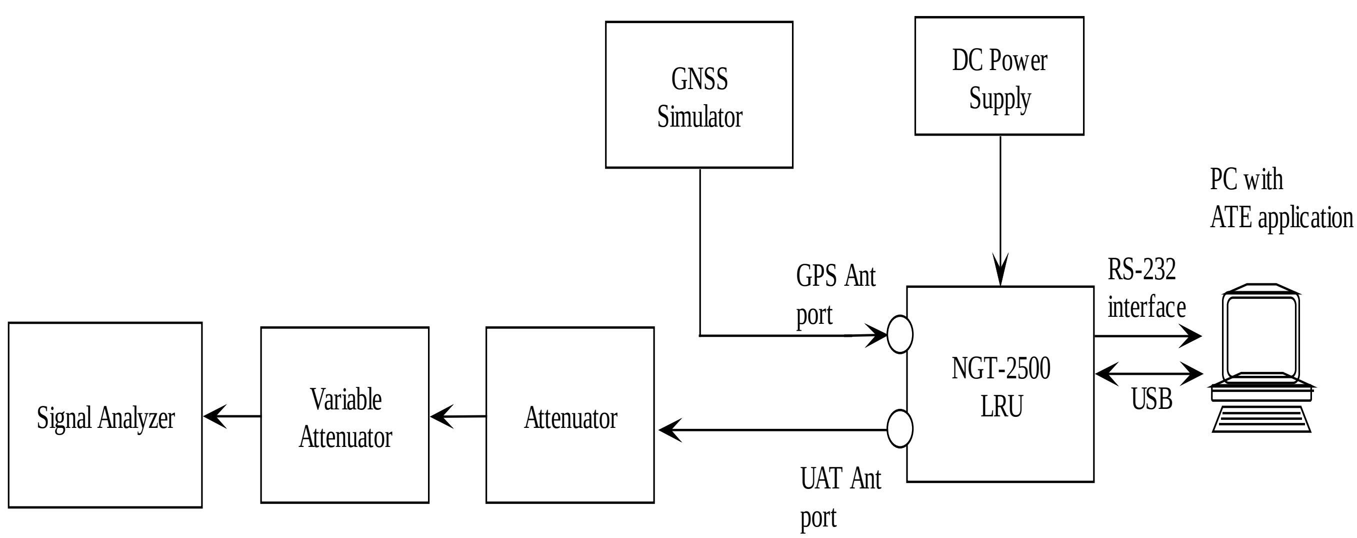


Figure 9-3: Modulation Characteristics Test Setup for UAT Transmission

9.2.1.3 Modulation Characteristics Test Procedure

1. Connect the equipment as shown in Figure 9-3
2. Adjust the variable attenuator such that 978MHz signal power level at the input of Signal Analyzer is –40 ± 1dBm (Total attenuation required between UAT antenna port of UUT and Signal Analyzer input: 87dB approx.)
3. Configure the Signal Analyzer as per the settings given in Table 9-6
4. Configure the NGT-2500 unit to transmit one long message per second with payload data containing alternate one's and zero's using ATE application and control panel.
5. Record the frequency deviation values for bit '1' and bit '0' on Trace-1 and collect the screen shots
6. Record the carrier offset value and frequency deviation displayed on Trace-4 and collect the screen shot
7. Override the NGT-2500 to transmit long messages with pseudo-random payload data
8. Collect the screen shot of eye diagram on Trace-3

Table 9-6: Signal Analyzer settings for carrier-offset measurement for UAT transmission

Parameter Item/Function	Parameter Setting Value
Instrument Mode	Digital Demodulation
Instrument Mode / demodulation setup / demodulation format	2-FSK
Instrument Mode / demodulation setup / symbol rate	1.041667 Mbps
Instrument Mode / demodulation setup / result [message] length	420 symbols
Instrument Mode / demodulation setup / measurement filter	off
Instrument Mode / demodulation setup / reference filter	raised cosine
Instrument Mode / demodulation setup / [filter] alpha	0.5
Instrument Mode / demodulation setup / normalize	off
Frequency / center frequency	978 MHz
Frequency / frequency span	3.255 MHz
Range / channel 1 [signal] range	-40dBm
Time / result [message] length	420 symbols
Time / points/symbol	4
Average / average	on
Average / number of averages	10
Average / average type	rms exponential
Trigger / trigger type	External (Negative)
Trace 1 - Measurement Data	FSK measured time
Trace 1 - Data Format	part real (I)
Trace 1 - RefLvl/Scale / Y per division	78.125 kHz
Trace 3 - Measurement Data	FSK measure
Trace 3 - Data Format	eye diagram
Trace 3 - Data Format / more format setup / eye length	1
Trace 3 - RefLvl/Scale / Y per division	70 kHz
Trace 4 - Measurement Data	symbol table/error summary

9.2.1.4 Modulation Characteristics Test Results

The measured modulation related parameters are mentioned in Table 9-7

Table 9-7: NGT-2500 Modulation related parameter measurement

NGT-2500 Modulation Characteristics of UAT Transmission		Limits
Measurement	UAT antenna port	
Carrier Offset	-2.6716 kHz	±19.56 kHz
Frequency Deviation	309 kHz	Minimum 280 kHz
Frequency Deviation for bit ‘1’	+307.0813 kHz	Minimum +280 kHz
Frequency Deviation for bit ‘0’	-308.9458 kHz	Maximum -280 kHz
Minimum Horizontal Eye Opening	0.86 us	Minimum 0.624 us
Minimum Vertical Eye Opening	580 kHz	Minimum 560 kHz

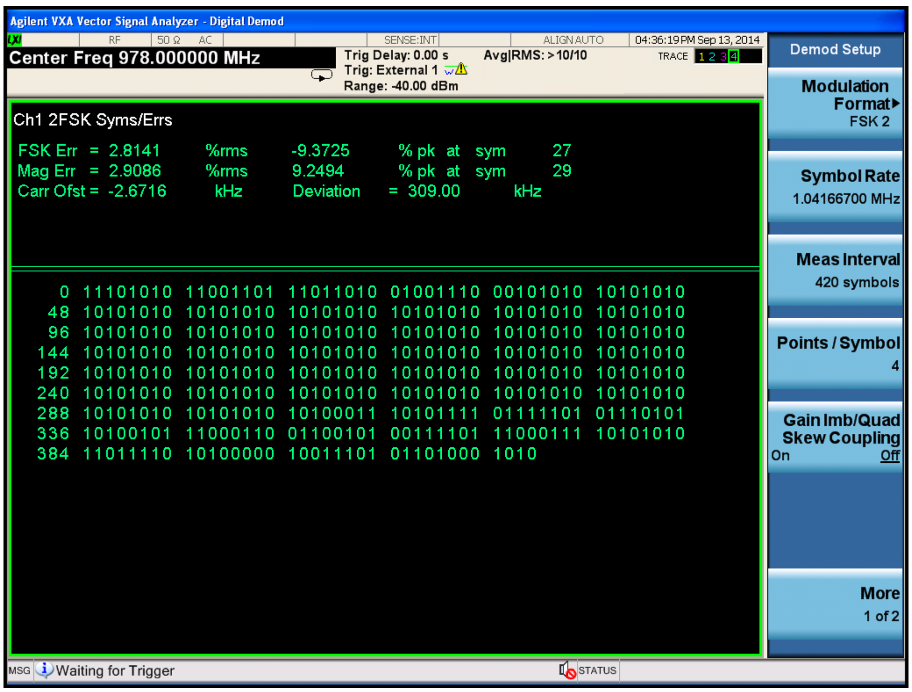


Figure 9-4: Carrier offset measurement of UAT transmission

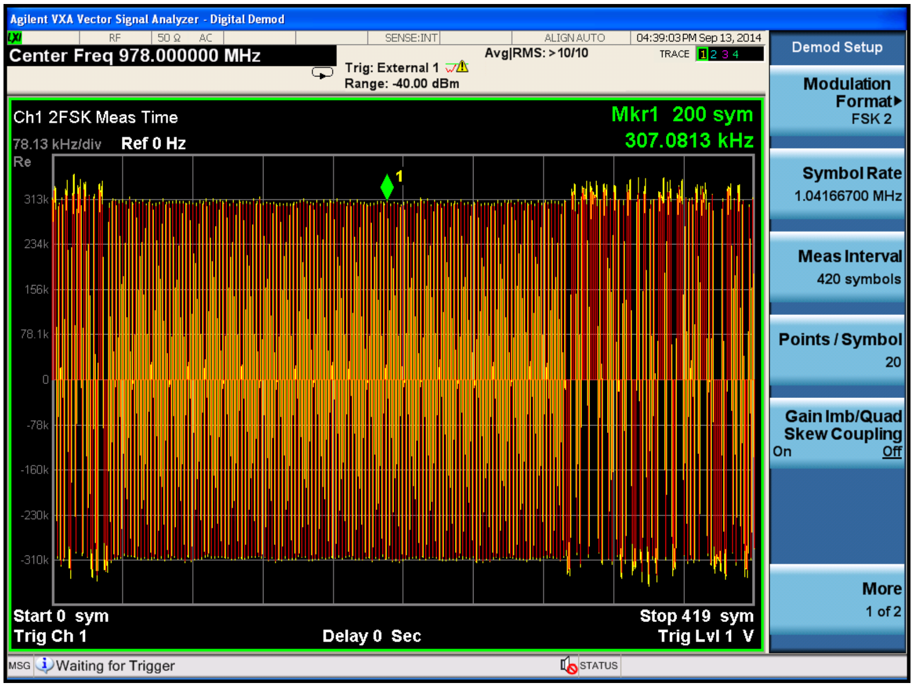


Figure 9-5: Frequency deviation for bit '1'

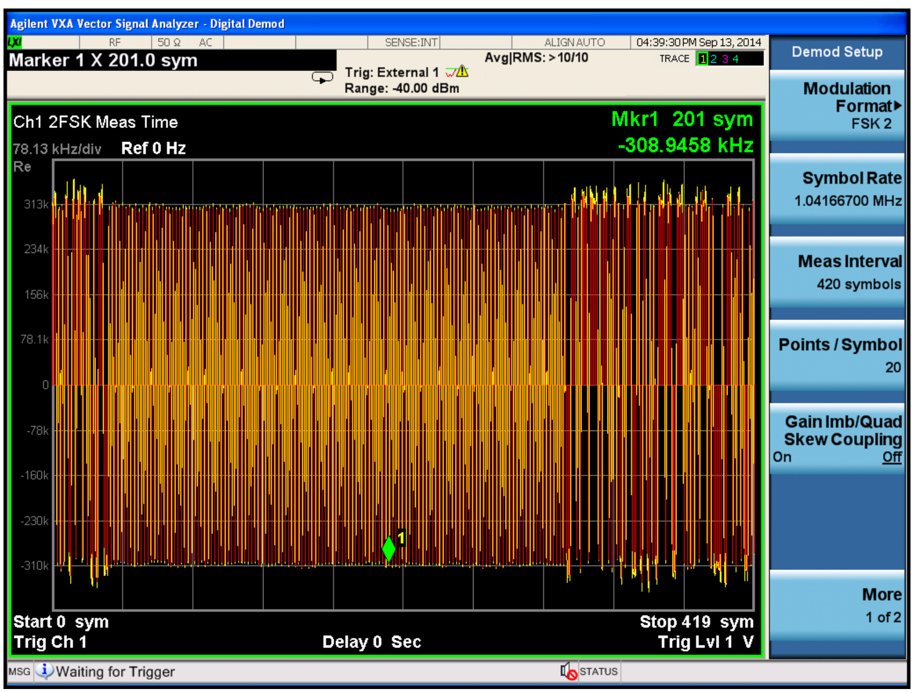


Figure 9-6: Frequency deviation for bit '0

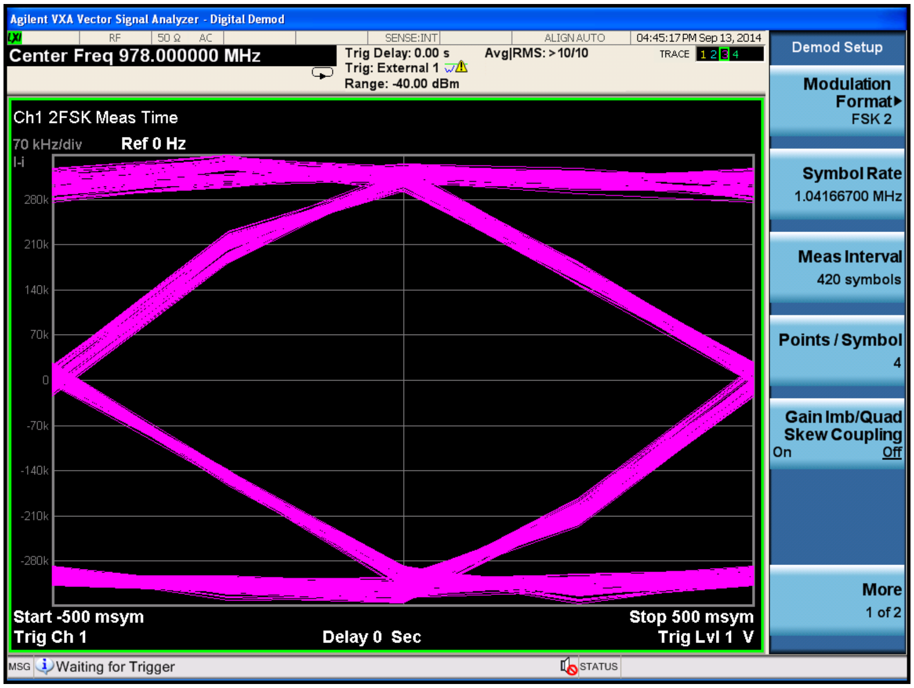


Figure 9-7: Eye diagram of UAT transmission

9.2.2 Mode A Interrogation

Table 9-8: Modulation Characteristics Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Circulator	Renaissance Communications Private Limited	A2NN
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Tunable Band Pass Filter (Tuned to 1030MHz)	Telonic Berkeley Inc.	TTF 1000
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.2.2.1 Modulation Characteristics Test Setup

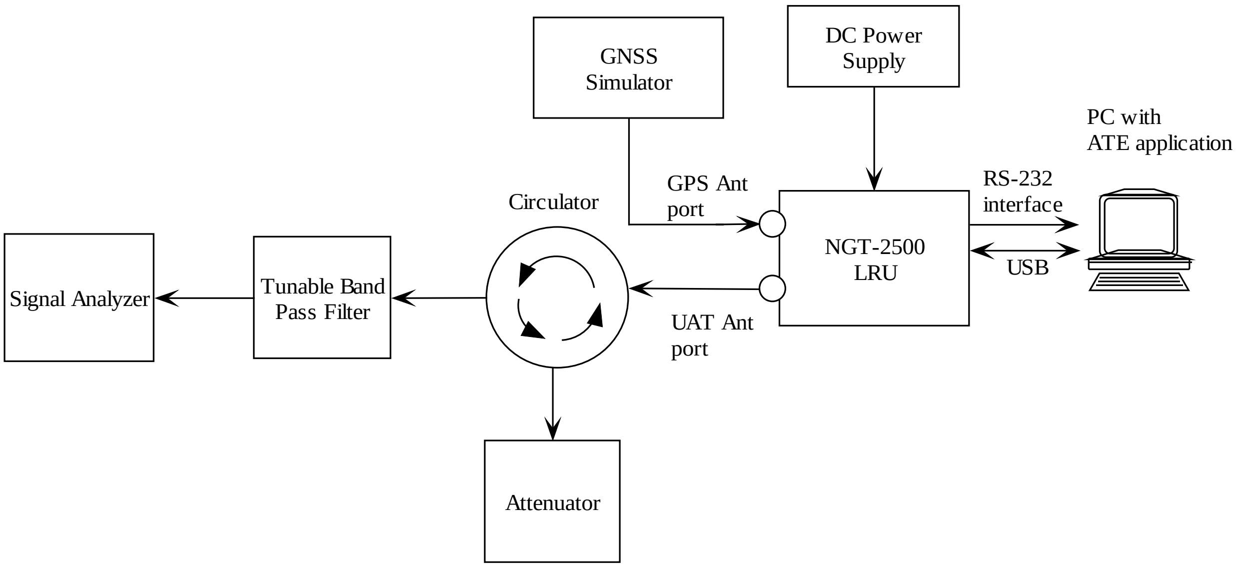


Figure 9-8: Modulation Characteristics Test Setup for Mode A Interrogation

9.2.2.2 Modulation Characteristics Test Procedure

1. Connect the equipment as shown in Figure 9-8 above.
2. Configure the Signal Analyzer as per below settings
   - Center frequency: 1030 MHz
   - Span: 0 Hz
   - Resolution bandwidth: 8 MHz
   - Video bandwidth: 50 MHz
   - Sweep time: 1 us
   - Trigger type: Video
   - Trigger delay: -500 ns
   - Amplitude/ mode: Linear
   - Reference level offset: Total attenuation between the unit and Signal Analyzer
3. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel.
4. Adjust the trigger delay and measure the following parameters of P1 and P3 pulses
   - Rise time
   - Fall time
   - Pulse width
5. Change the sweep time to 10us and trigger delay to -1 us. Measure the spacing between P1 pulse and P3 pulse.

9.2.2.3 Modulation Characteristics Test Results

The measured modulation related parameters are mentioned in Table 9-9

Table 9-9: NGT-2500 Modulation related parameter measurement

NGT-2500 Modulation Characteristics of Mode A Interrogation		Limit
Measurement	**UAT antenna port**	
Rise time of P1 pulse	88.8 ns	Maximum 100 ns
Rise time of P3 pulse	79.8 ns	Maximum 100 ns
Fall time of P1 pulse	87.7 ns	Maximum 200 ns
Fall time of P3 pulse	126.7 ns	Maximum 200 ns
Pulse width of P1 pulse	780 ns	800 ns ± 50 ns
Pulse width of P3 pulse	790.5 ns	800 ns ± 50 ns
Pulse spacing between P1 pulse and P3 pulse	8 us	8.0 ± 0.1 us

- **Rise time measurement:**

The rise time was measured using 8MHz resolution bandwidth. Considering the rise time of a cascaded network, the measured rise time can be related to the rise time of the pulse and rise time of Signal Analyzer as,
Measured rise time = $\sqrt{(\text{Rise time of the pulse})^2 + (\text{Rise time of Signal Analyzer})^2}$

Measured rise time for P1 pulse: 99 ns
Rise time introduced by signal Analyzer: 43.75 ns
Rise time of P1 pulse = $\sqrt{(\text{Measured rise time})^2 - (\text{Rise time of Signal Analyzer})^2}$
Rise time of P1 pulse = $\sqrt{99^2 - 43.75^2}$
Rise time of P1 pulse = 88.8 ns

Figure 9-9: Rise time measurement of P1 pulse

Measured rise time for P3 pulse: 91 ns
Rise time introduced by signal Analyzer: 43.75 ns
Rise time of P3 pulse = √ ((Measured rise time)^2- (Rise time of Signal Analyzer)^2)
Rise time of P1 pulse = √(91^2 – 43.75^2)
Rise time of P1 pulse = 79.8 ns

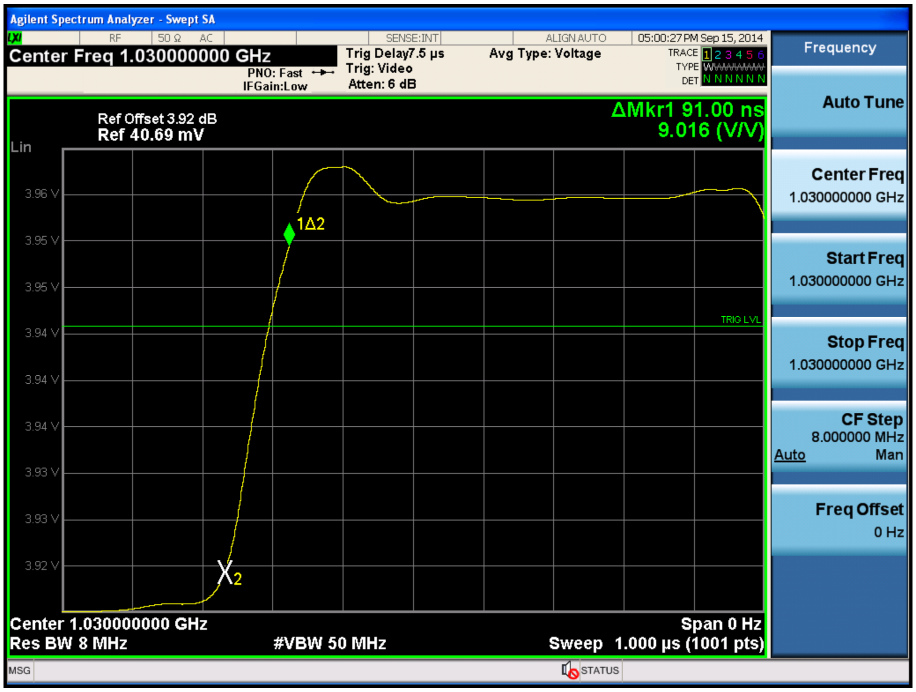


Figure 9-10: Rise time measurement of P3 pulse

- **Fall time measurement:**

The fall time was measured using 8MHz resolution bandwidth. Considering the fall time of a cascaded network, the measured fall time can be related to the fall time of the pulse and fall time of Signal Analyzer as,
Measured fall time = √ ((Fall time of the pulse) ^{2} + (Fall time of Signal Analyzer) ^{2})

Measured fall time for P1 pulse: 98 ns
Fall time introduced by signal Analyzer: 43.75 ns
Fall time of P1 pulse = √ ((Measured fall time) ^{2}- (Fall time of Signal Analyzer) ^{2})
Fall time of P1 pulse = $\sqrt{(99^2 – 43.75^2)}$
Fall time of P1 pulse = 87.7 ns

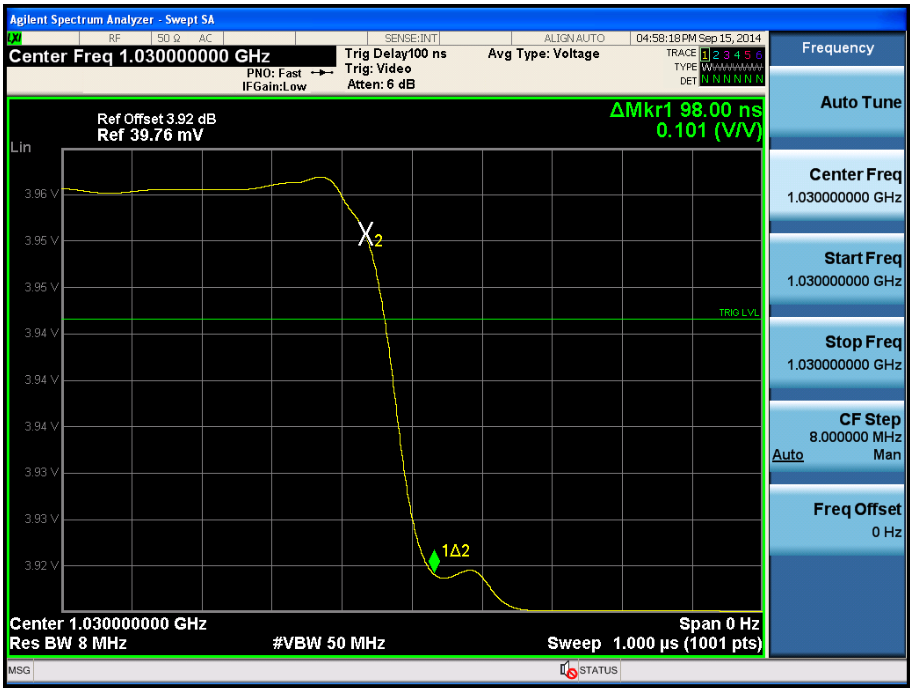


Figure 9-11: Fall time measurement of P1 pulse

Measured fall time for P3 pulse: 134 ns
Fall time introduced by signal Analyzer: 43.75 ns
Fall time of P3 pulse = $\sqrt{((\text{Measured fall time})^2 - (\text{Fall time of Signal Analyzer})^2)}$
Fall time of P3 pulse = $\sqrt{(134^2 - 43.75^2)}$
Fall time of P3 pulse = 126.7 ns

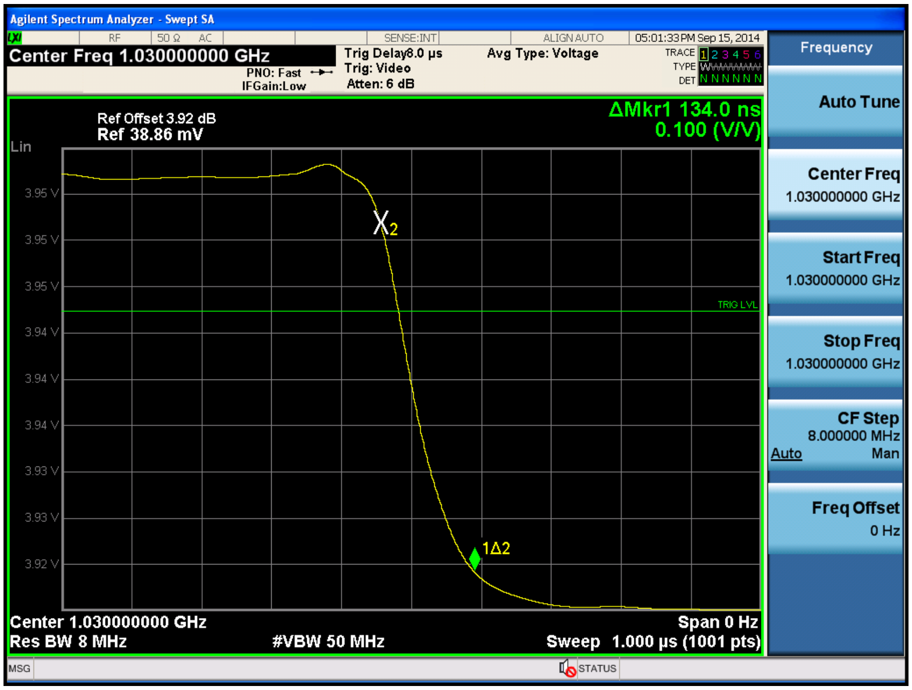


Figure 9-12: Fall time measurement of P3 pulse

- **Pulse width measurement**

Measured pulse width of P1 pulse: 780 ns

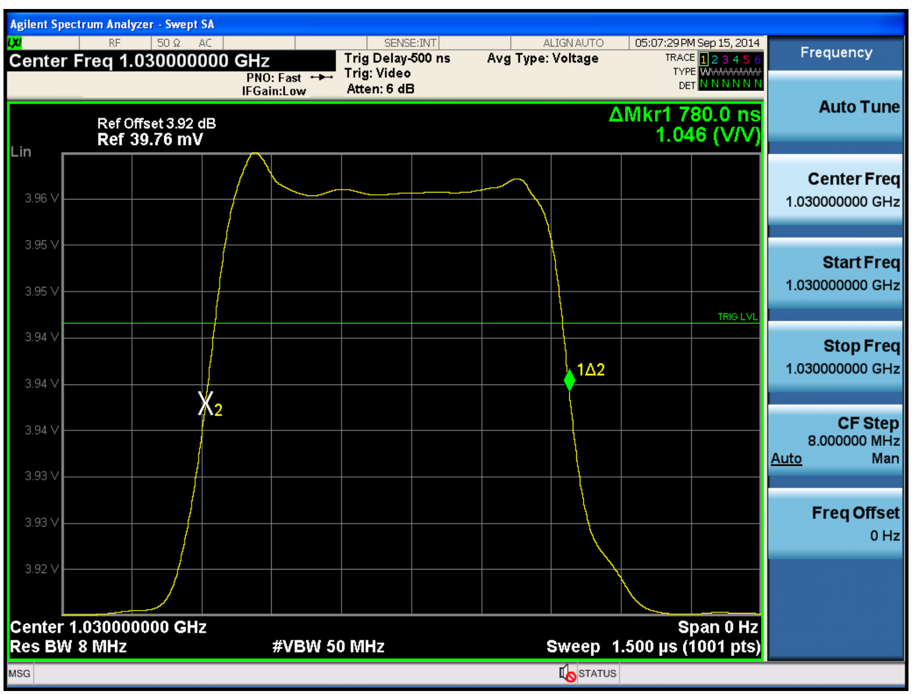


Figure 9-13: Pulse width measurement of P1 pulse

Measured pulse width of P3 pulse: 790.5 ns

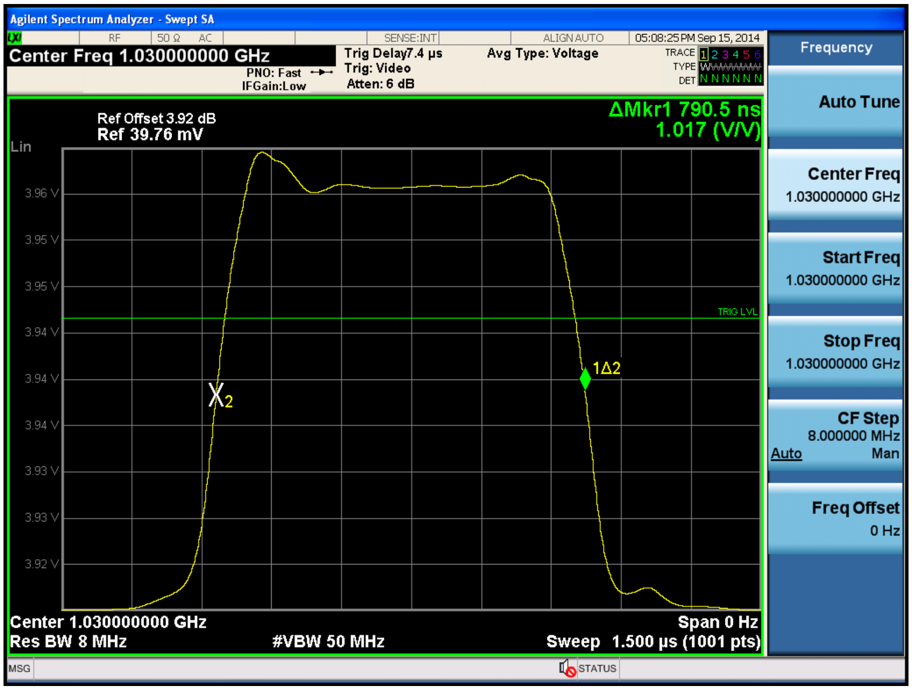


Figure 9-14: Pulse width measurement of P3 pulse

- **Pulse spacing**

Measured pulse spacing between P1 pulse and P3 pulse: 8 us

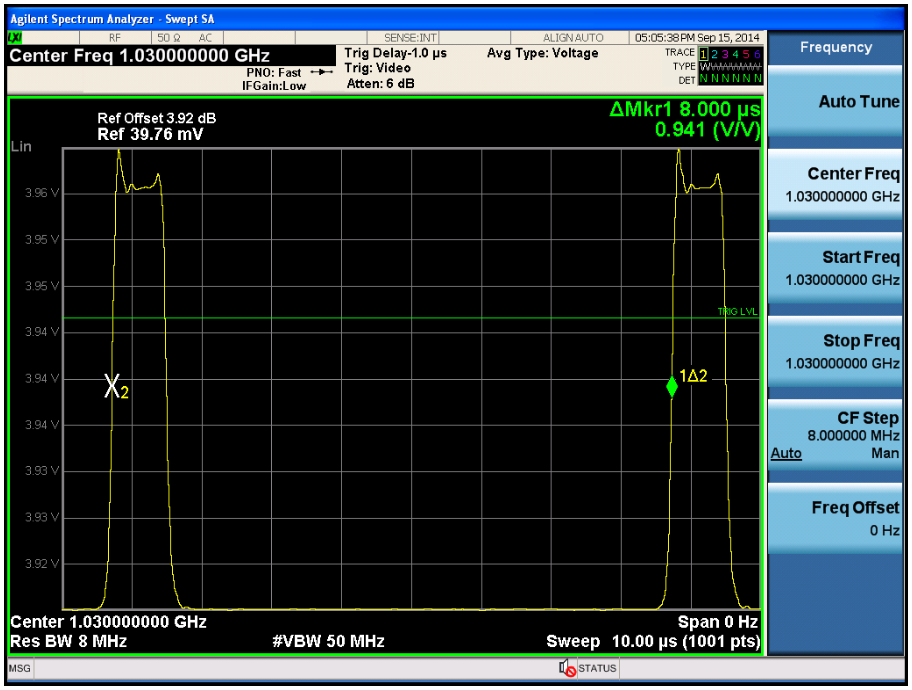


Figure 9-15: Pulse spacing measurement between P1 pulse and P3 pulse

9.3 Occupied Bandwidth

47CFR Reference:
2.1049, Occupied Bandwidth
87.135, Bandwidth of Emission

Occupied bandwidth is defined in 47CFR2.1049 as *"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."*

9.3.1 UAT Transmission

9.3.1.1 Occupied Bandwidth Test Equipment Required

Table 9-10: Occupied Bandwidth Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Variable Attenuator (or Equivalent)	Fairview Microwave	SA35110
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.3.1.2 Occupied Bandwidth Test Setup

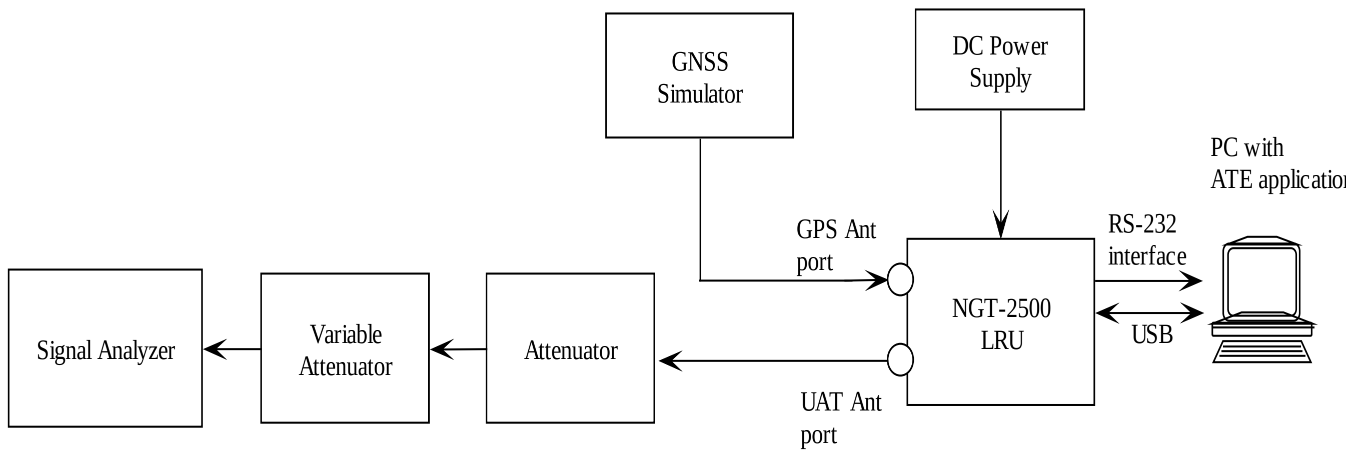


Figure 9-16: Occupied Bandwidth Test Setup for UAT Transmission

9.3.1.3 Occupied Bandwidth Test Procedure

1. Connect the equipment as shown in Figure 9-16 above.
2. Adjust the variable attenuator such that 978MHz signal power level at the input of Signal Analyzer is –6 ± 1 dBm (Total attenuation required between UAT antenna port of UUT and Signal Analyzer input: 53 dB approx.)
3. Configure the Signal Analyzer as per below settings
   - Measurement mode: Occupied bandwidth measurement
   - Center frequency: 978 MHz
   - Span: 7 MHz
   - Resolution bandwidth: 62 kHz
   - Video bandwidth: 620 kHz
   - Sweep time: Auto
   - Trace/Max hold: ON
   - Reference level offset: Total attenuation between the unit and Signal Analyzer
   - Reference level: +55 dBm
4. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel.
5. Allow the spectrum to fill up completely
6. Record the displayed occupied bandwidth value

9.3.1.4 Occupied Bandwidth Test Results

Measured occupied bandwidth is mentioned in Table 9-11.

Table 9-11 Occupied Bandwidth

NGT-2500 Occupied Bandwidth of UAT Transmission		Limit
Measurement	**UAT antenna port**	
Occupied bandwidth (MHz)	1.1151 MHz	1.3 MHz

9.3.2 Mode A Interrogation

Table 9-12: Occupied Bandwidth Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Circulator	Renaissance Communications Private Limited	A2NN
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Tunable Band Pass Filter (Tuned to 1030MHz)	Telonic Berkeley Inc.	TTF 1000
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.3.2.1 Occupied Bandwidth Test Setup

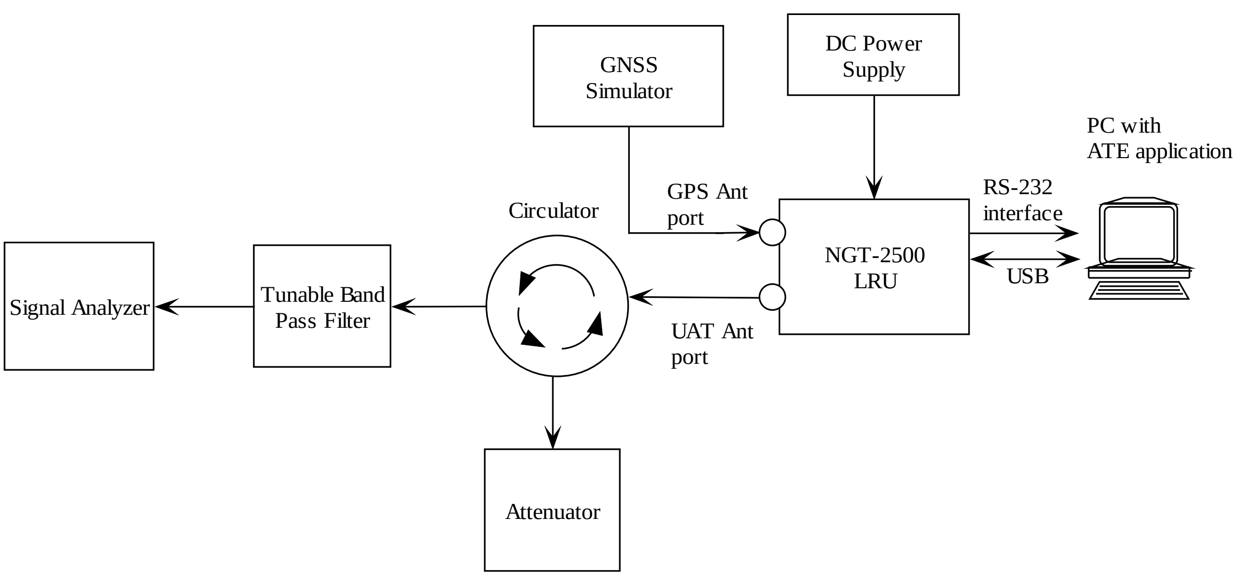


Figure 9-17: Occupied Bandwidth Test Setup for Mode A Interrogation

9.3.2.2 Occupied Bandwidth Test Procedure

1. Connect the equipment as shown in Figure 9-17 above.
2. Configure the Signal Analyzer as per below settings
    - Measurement mode: Occupied bandwidth measurement
    - Center frequency: 1030 MHz
    - Span: 8 MHz
    - Resolution bandwidth: 2 MHz
    - Video bandwidth: 8 MHz
    - Sweep time: 1 second
    - Trace/Max hold: ON
    - Reference level offset: Total attenuation between the unit and Signal Analyzer
    - Reference level: 0 dBm
3. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel.
4. Allow the spectrum to fill up completely
5. Record the displayed occupied bandwidth value

9.3.2.3 Occupied Bandwidth Test Results

Measured occupied bandwidth is mentioned in Table 9-13

Table 9-13: Occupied Bandwidth

NGT-2500 Occupied Bandwidth of Mode A Interrogation		Limit
Measurement	**UAT antenna port**	
Occupied bandwidth (MHz)	7.6966 MHz	8 MHz

9.4 Spurious Emissions at Antenna Terminals

47CFR Reference:
2.1051, Spurious Emissions at Antenna Terminals
87.139, Emission Limitations

47CFR2.1051 states that the radio frequency voltages or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna.

47CFR2.1051 says that curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec 2.1049 (Occupied Bandwidth) as appropriate.

9.4.1 UAT Transmission

9.4.1.1 Spurious Emissions at Antenna Terminals Test Equipment Required

Table 9-14: Spurious Emissions at Antenna Terminals Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Attenuator-1 (Or Equivalent)	Narda	766-10
Attenuator-2 (Or Equivalent)	Emerson Network Power	ATT-488M-40-SMA-07
Attenuator-3 (Equivalent)	Arra Inc	Arra Inc
Spectrum Analyzer	Rohde and Schwarz	FSV30
GPS Simulator	Spirent	GSS6700
DC Power Supply	Agilent	E3610A
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.4.1.2 Spurious Emissions at Antenna Terminals Test Setup

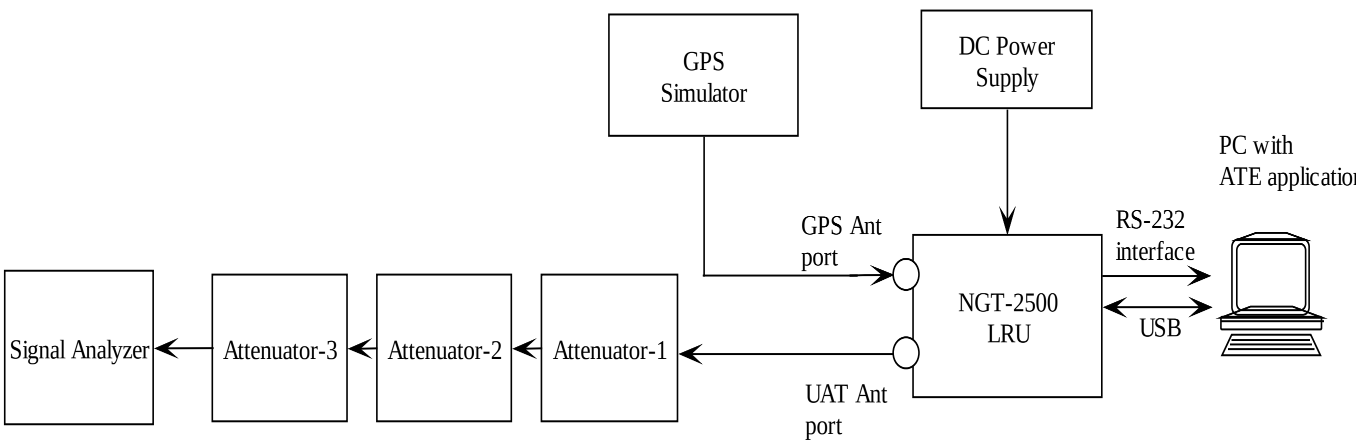


Figure 9-18: Spurious Emissions at Antenna Terminals Test Setup for UAT Transmission

9.4.1.3 Spurious Emissions at Antenna Terminals Test Procedure

1. Connect the equipment as shown in Figure 9-18 above.
2. A total attenuation 53 dB approx. is provided at the output of UAT antenna port
3. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel
4. Record all the spurious emissions below 2 GHz. Use 200 MHz spans and a 100 kHz resolution bandwidth on the Spectrum Analyzer
5. Record the spurious emission levels of the harmonic frequencies up to the tenth harmonic of the UAT transmission frequency (1956 MHz, 2934 MHz, 3912 MHz, 4890 MHz, 5868 MHz, 6846 MHz, 7824 MHz, 8802 MHz and 9780 MHz)
6. Measure and record Attenuator/filter/cable calibration factor for each harmonic.

9.4.1.4 Spurious Emissions at Antenna Terminals Test Results

Refer to Appendix A for NGT-2500 test results for Spurious Emissions at the Antenna Terminals

9.4.2 Mode A Interrogation

9.4.2.1 Spurious Emissions at Antenna Terminals Test Equipment Required

Table 9-15: Spurious Emissions at Antenna Terminals Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Circulator	TRAK	C095012/DA
50Ohm Termination	Mini-circuits	ANNE-50L+
Tunable Band reject Filter (Tuned to 978 MHz)	Maurya microwave Corp.	1829
Attenuator (Equivalent)	Narda	766-10
Spectrum Analyzer	Rohde and Schwarz	FSV30
GPS Simulator	Spirent	GSS6700
DC Power Supply	Agilent	E3610A
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.4.2.2 Spurious Emissions at Antenna Terminals Test Setup

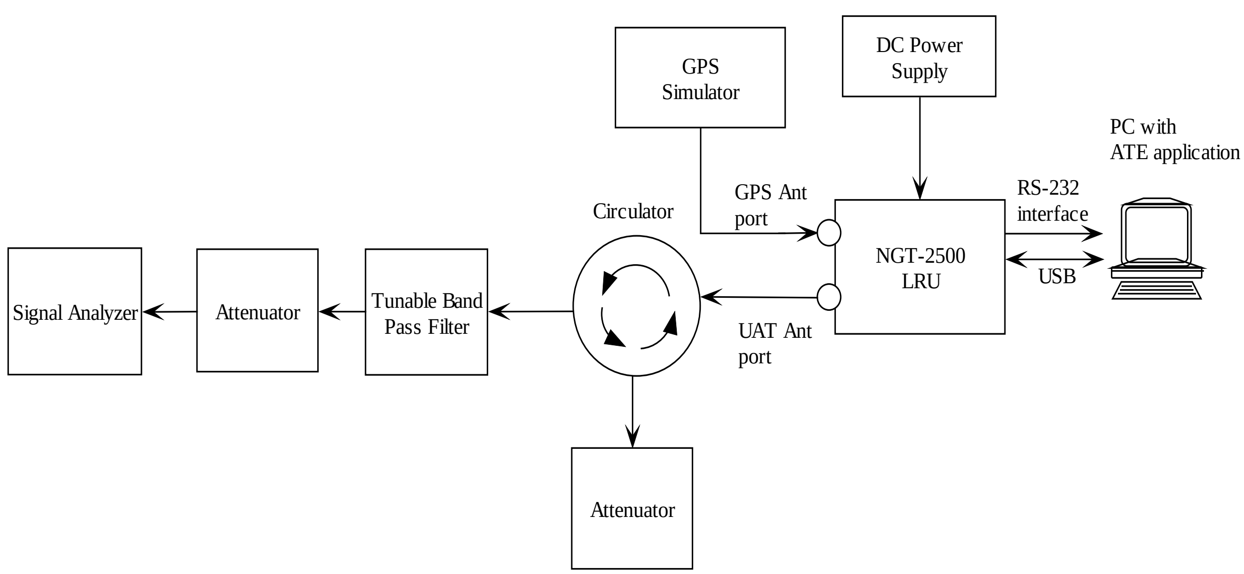


Figure 9-19: Spurious Emissions at Antenna Terminals Test Setup for Mode A Interrogation

9.4.2.3 Spurious Emissions at Antenna Terminals Test Procedure

1. Connect the equipment as shown in Figure 9-19 above.
2. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel
3. Record all the spurious emissions below 2 GHz. Use 200 MHz spans and a 300 kHz resolution bandwidth on the Spectrum Analyzer

4. Record the spurious emission levels of the harmonic frequencies up to the tenth harmonic of the Mode A interrogation frequency (2060 MHz, 3090 MHz, 4120 MHz, 5150 MHz, 6180 MHz, 7210 MHz, 8240 MHz, 9270 MHz and 10300 MHz)
5. Measure and record Attenuator/filter/cable calibration factor for each harmonic.

9.4.2.4 Spurious Emissions at Antenna Terminals Test Results

Refer to Appendix A for NGT-2500 test results for Spurious Emissions at the Antenna Terminals

9.5 Spurious Emissions at Antenna Terminals Local Oscillator Leakage (907.4 MHz)

9.5.1 Spurious Emissions at Antenna Terminals Local Oscillator Leakage (907.4 MHz) Test Equipment Required

Table 9-16: Spurious Emissions at Antenna Terminals Local Oscillator Leakage (907.4 MHz) Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Spectrum Analyzer	Agilent	N9020A
GPS Simulator	Spirent	GSS6700
DC Power Supply	Agilent	E3610A
ATE Application	Accord	ATE-APP-2.20

9.5.2 Spurious Emissions at Antenna Terminals Local Oscillator Leakage Test Setup

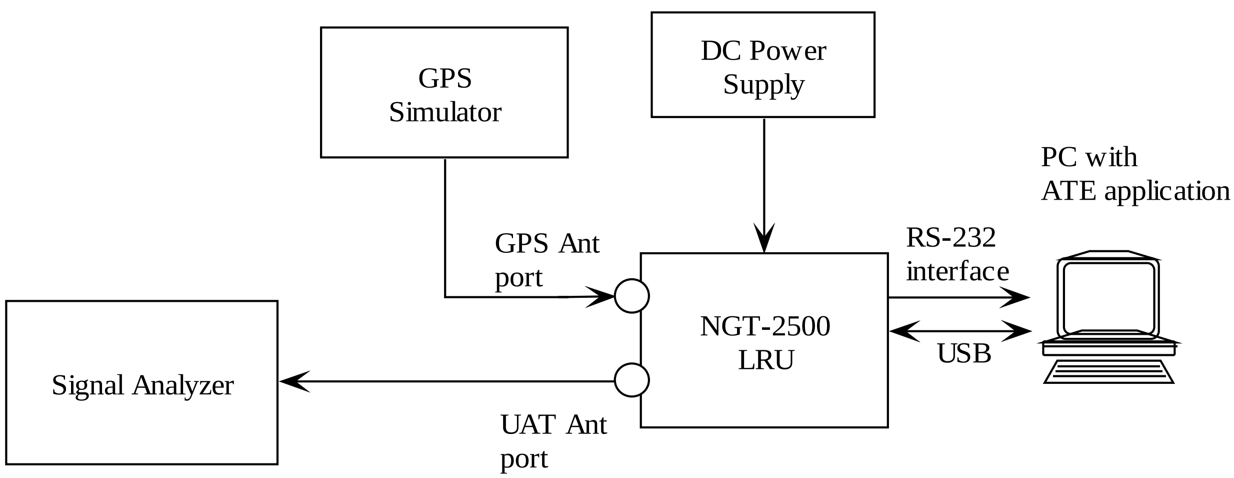


Figure 9-20: Spurious Emissions at Antenna Terminals Local Oscillator Leakage Test Setup

9.5.3 Spurious Emissions at Antenna Terminals Local Oscillator Leakage Test Procedure

1 Connect the equipment as shown in Figure 9-20 above.
2 Configure the spectrum analyzer for a center frequency of 907.4 MHz and 1814.8 MHz, 100 kHz resolution bandwidth, and a span of 100 MHz
3 Configure the NGT-2500 to be in standby mode.

4 Prior to performing the measurement, verify that the NGT-2500 is not transmitting.
5 Using a spectrum analyzer, measure and record the leakage of LO signal and its second harmonic out of the UAT antenna port.

9.5.4 Spurious Emissions at Antenna Terminals Test Results

LO Leakage At UAT Antenna Port				Limit
Frequency (MHz)	**Measured power (dBm)**	**Calibration Factor (dB)**	**LO leakage Corrected (dBm)**	
907.4 (Fundamental)	-84.392	0.8	-83.592	-13dBm
1814.8(2nd Harmonic of LO frequency)	-79.219	0.8	-78.419	-13dBm

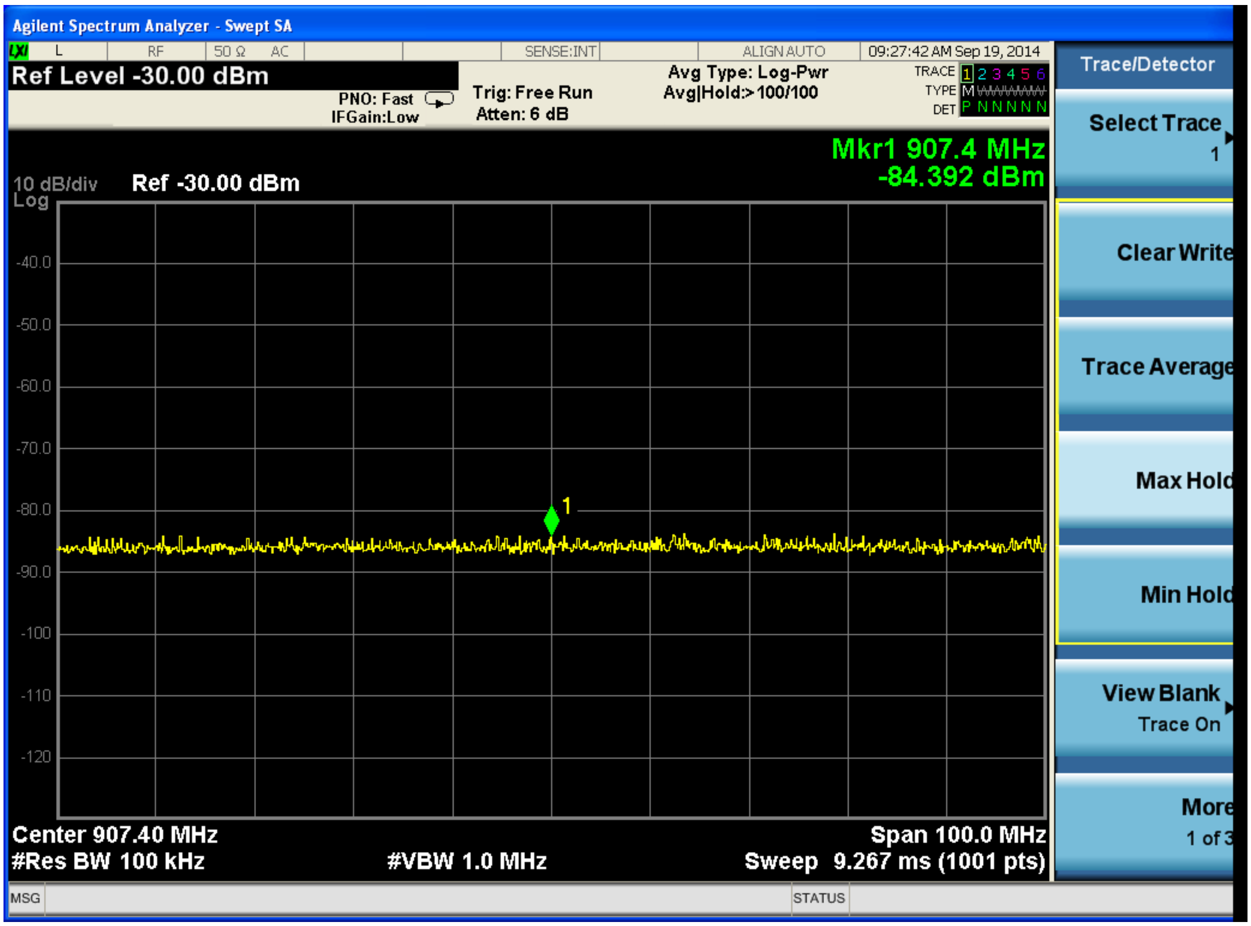


Figure 9-21: Leakage Of Fundamental LO frequency

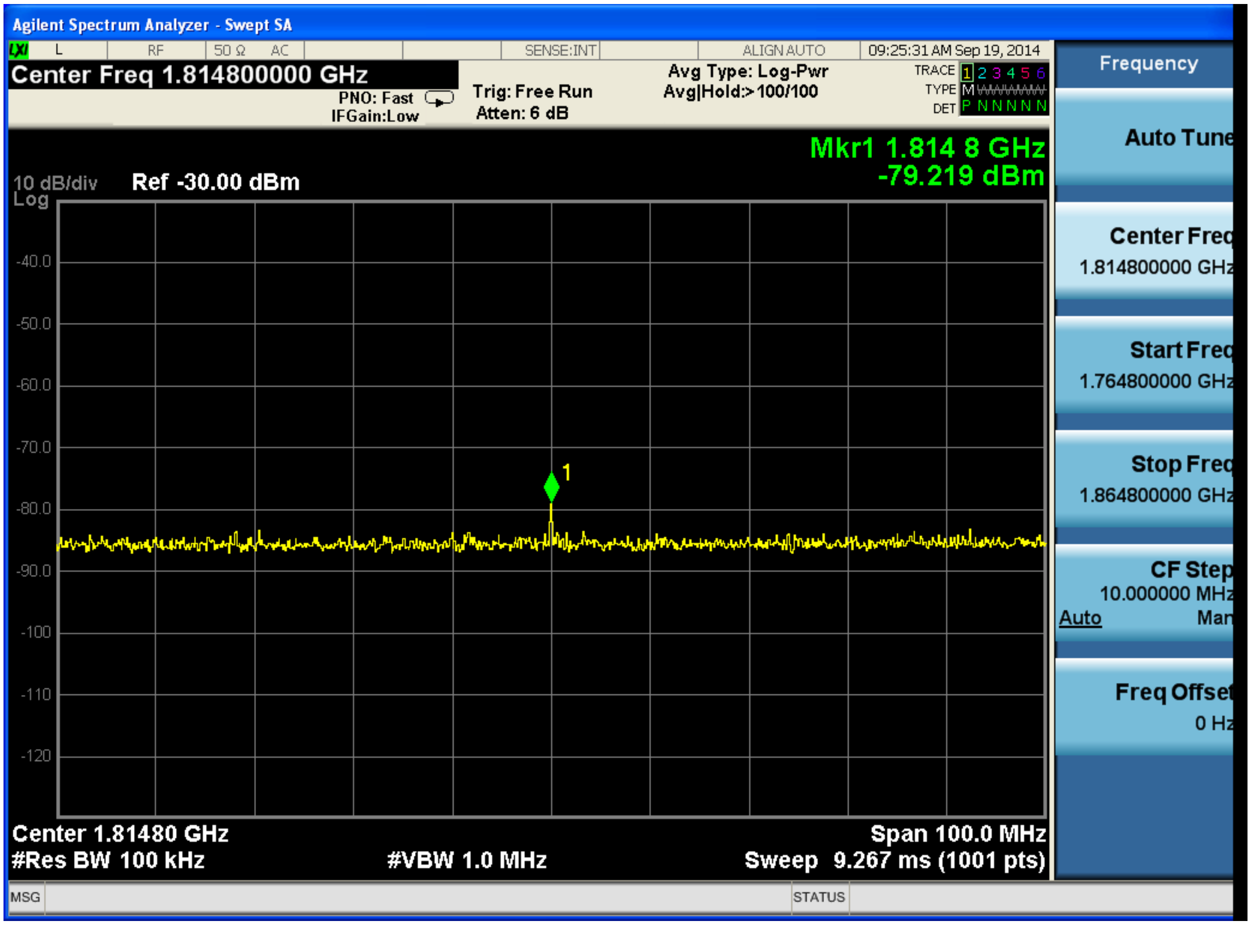


Figure 9-22: Leakage Of Second Harmonic Of LO frequency

9.6 Field Strength of Spurious Radiation

47CFR References:
2.1053, Field Strength of Spurious Radiation
15.109, Radiated Emission Limits
15.31, Measurement Standards
15.33, Frequency Range of Radiated Measurements
87.139, Emission Limitations

9.6.1 Field Strength of Spurious Radiation Test Equipment Required

Table 9-17: Field Strength of Spurious Radiation Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Attenuator-1 (Equivalent)	Narda	766-10
Attenuator-2 (Equivalent)	Emerson Network Power	ATT-488M-40-SMA-07

Equipment/Application	Manufacturer	Model
Attenuator-3 (Equivalent)	Arra Inc	Arra Inc
Bicon Antenna	Schwarzbeck	BBA9106
Log P Antenna	Schwarzbeck	UHAL09107
DRG Horn Antenna	AH Systems	SAS-571
GPS Simulator	Spirent	GSS6700
DC Power Supply	Agilent	E3610A
Spectrum Analyzer	Rohde and Schwarz	FSV30
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.6.2 Field Strength of Spurious Radiation Test Setup

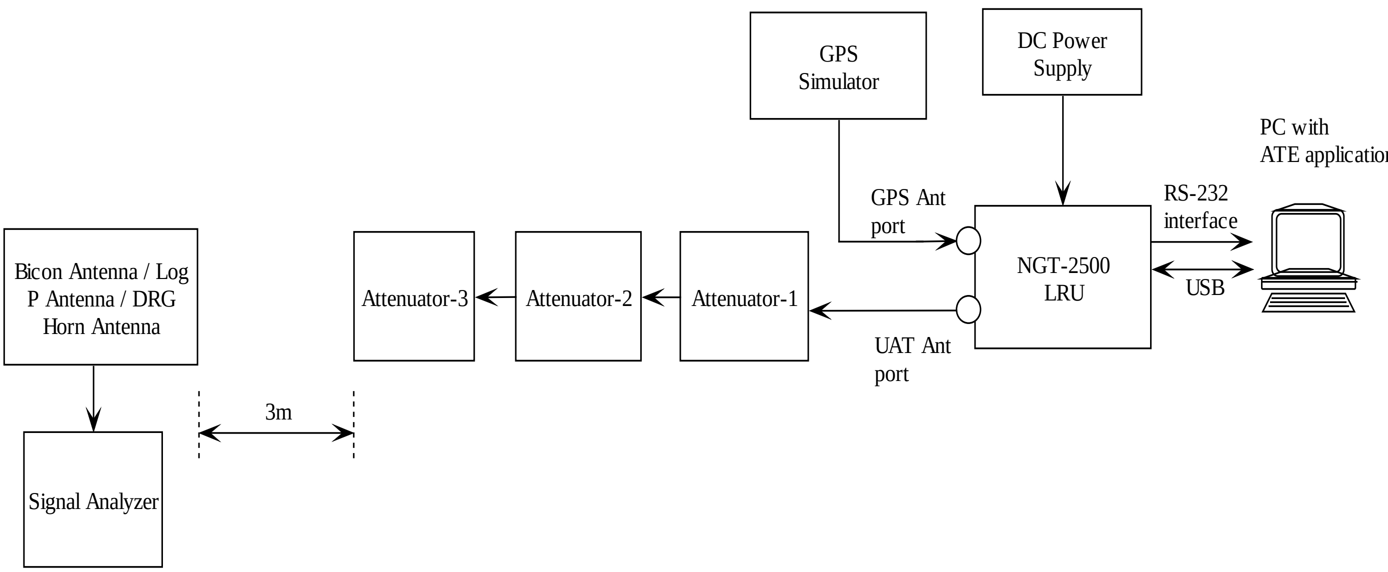


Figure 9-23: Field Strength of Spurious Radiation Test Setup

9.6.3 Field Strength of Spurious Radiation Test Procedure

1. Connect the equipment as shown in Figure 9-23 above.
2. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel. Measure all spurious emissions till 10^{th} harmonic of 1030 MHz. Dwell at harmonics of 978 MHz and 1030 MHz.
3. Configure the NGT-2500 unit to disable UAT transmissions and measure the unintentional radiations till 30 GHz.
4. Calculate the field strength at 3 m using the recorded power measurement, antenna factor and cable loss for each frequency.

9.6.4 Field Strength of Spurious Radiation Test Results

Refer to Appendix A for NGT-2500 test results for Field Strength of Spurious Radiation test results

9.7 Frequency Stability

9.7.1 Frequency Stability (Temperature Variation)

47CFR Reference:
2.1055, Frequency Stability
15.31, Measurement Standards
87.133, Frequency Stability

9.7.1.1 UAT Transmission

9.7.1.1.1 Frequency Stability (Temperature Variation) Test Equipment Required

Table 9-18: Frequency Stability (Temperature Variation) Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Variable Attenuator (or Equivalent)	Fairview Microwave	SA35110
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.7.1.1.2 Frequency Stability (Temperature Variation) Test Setup

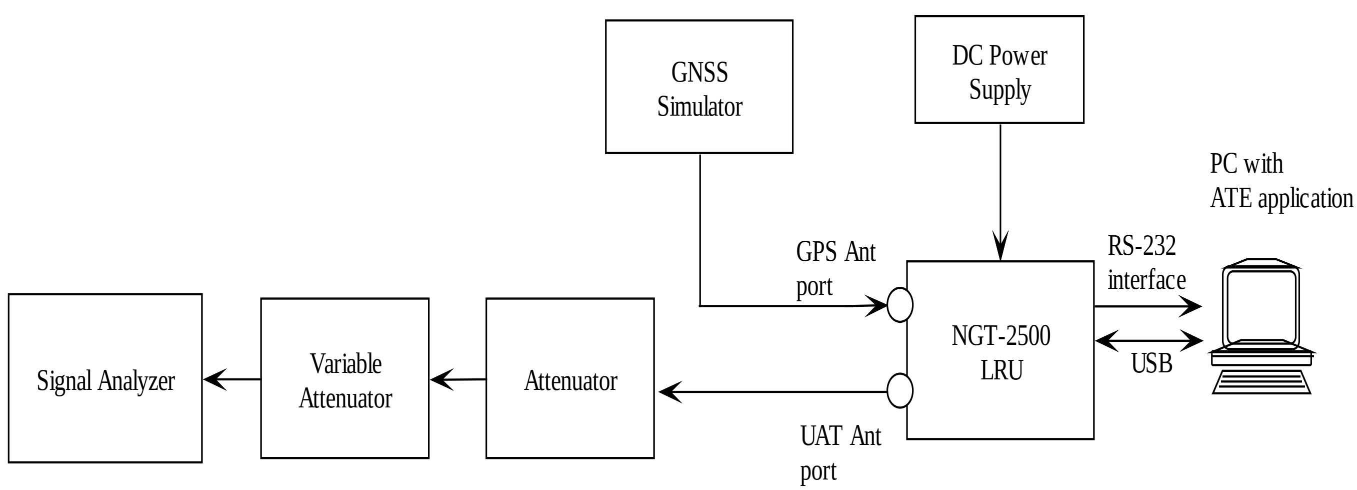


Figure 9-24: Frequency Stability (Temperature Variation) Test Setup for UAT Transmission

9.7.1.1.3 Frequency Stability (Temperature Variation) Test Procedure

1. Connect the equipment as shown in Figure 9-24 above.

2. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel
3. Set the temperature chamber to -5°C and allow the transmitter (non-operating) temperature to stabilize.
4. Adjust the variable attenuator such that 978 MHz signal power level at the input of Signal Analyzer is –40 ± 1 dBm (Total attenuation required between UAT antenna port of UUT and Signal Analyzer input: 87 dB approx.)
5. Configure the Signal Analyzer as per the settings given in Table 9-6
6. Apply power to the unit and record the carrier offset value on Trace-4
7. Adjust the variable attenuator such that 978 MHz signal power level at the input of Signal Analyzer is –6 ± 1 dBm (Total attenuation required between UAT antenna port of UUT and Signal Analyzer input: 53 dB approx.)
8. Configure the Signal Analyzer as per below settings
    - Center frequency: 978 MHz
    - Span: 0 Hz
    - Resolution bandwidth: 2 MHz
    - Video bandwidth: 6 MHz
    - Sweep time: 1 ms
    - Trigger type: Video
    - Trigger delay: -250 us
    - Trace/Max hold: ON
    - Continuous peak search: ON
    - Reference level offset: Total attenuation between the unit and Signal Analyzer
    - Reference level: +55 dBm
9. Record peak output power for UAT transmission
10. Repeat steps 4 through 9 at -45°C, -40°C, -30°C, -20°C, -10°C, 0°C, +10°C, +20°C, +30°C, +40°C, +50°C, +60°C, and +70°C.
11. To calculate UAT transmission frequency, add the measured carrier offset value to 978MHz.

9.7.1.1.4 Frequency Stability (Temperature Variation) Test Results

The transmission frequency offset and the peak power output values recorded during the temperature variation test are tabulated in Table 9-19

Table 9-19: Frequency Stability (Temperature Variation) Test Results

NGT-2500 UAT Transmission			Limits	
Temp Deg C	**Power Output (dBm)**	**Measured Frequency (MHz)**	**Power Output**	**Frequency**
-45	+47.449	977.9912664	+44dBm to +48dBm	978MHz ± 19.56kHz
-40	+47.622	977.9907552	+44dBm to +48dBm	978MHz ± 19.56kHz
-30	+47.302	977.9900045	+44dBm to +48dBm	978MHz ± 19.56kHz
-20	+47.351	977.9883680	+44dBm to +48dBm	978MHz ± 19.56kHz
-10	+47.463	977.9876000	+44dBm to +48dBm	978MHz ± 19.56kHz
0	+47.162	977.9874270	+44dBm to +48dBm	978MHz ± 19.56kHz
10	+47.137	977.9902541	+44dBm to +48dBm	978MHz ± 19.56kHz
20	+46.725	977.9932426	+44dBm to +48dBm	978MHz ± 19.56kHz
30	+46.941	977.9973844	+44dBm to +48dBm	978MHz ± 19.56kHz
40	+46.857	977.9984638	+44dBm to +48dBm	978MHz ± 19.56kHz
50	+46.104	977.9993987	+44dBm to +48dBm	978MHz ± 19.56kHz
60	+47	977.9979162	+44dBm to +48dBm	978MHz ± 19.56kHz
70	+46.418	977.9964435	+44dBm to +48dBm	978MHz ± 19.56kHz

9.7.1.2 Mode A Interrogation

9.7.1.2.1 Frequency Stability (Temperature Variation) Test Equipment Required

Table 9-20: Frequency Stability (Temperature Variation) Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Circulator	Renaissance Communications Private Limited	A2NN
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Tunable Band Pass Filter (Tuned to 1030MHz)	Telonic Berkeley Inc.	TTF 1000
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.7.1.2.2 Frequency Stability (Temperature Variation) Test Setup

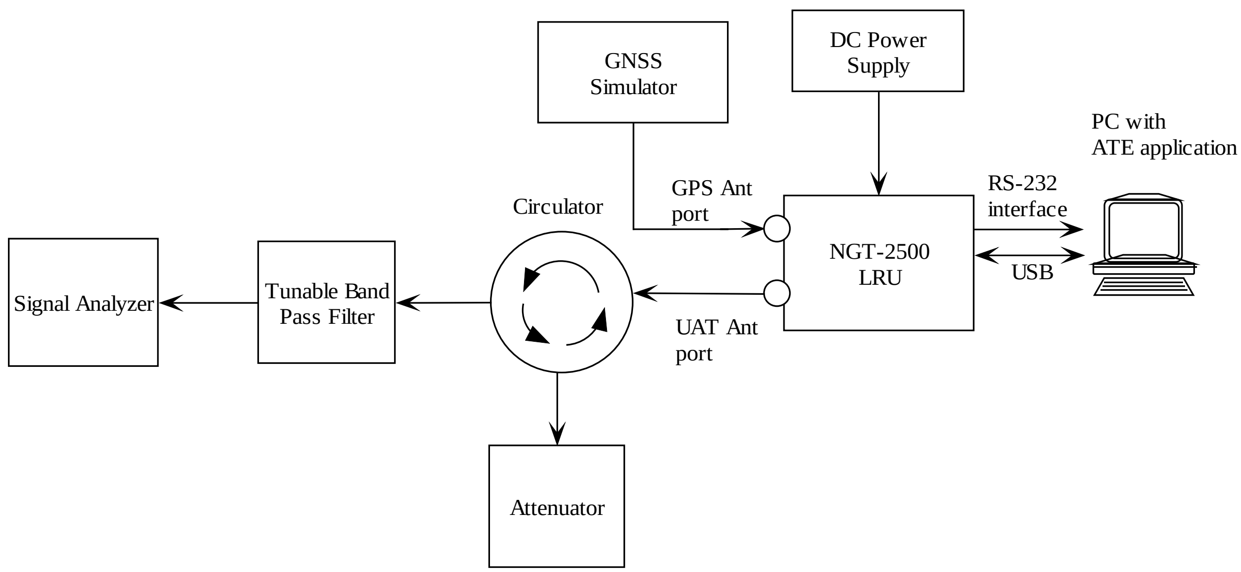


Figure 9-25: Frequency Stability (Temperature Variation) Test Setup for Mode A Interrogation

9.7.1.2.3 Frequency Stability (Temperature Variation) Test Procedure

1. Connect the equipment as shown in Figure 9-25 above.
2. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel
3. Set the temperature chamber to -5°C and allow the transmitter (non-operating) temperature to stabilize.
4. Configure the Signal Analyzer as per below settings
    - Center frequency: 1030 MHz
    - Span: 0 Hz
    - Resolution bandwidth: 8 MHz
    - Video bandwidth: 50 MHz
    - Sweep time: 20 us
    - Trigger type: Video
    - Trigger delay: -5 us
    - Trace/Max hold: ON
    - Continuous peak search: ON
    - Reference level offset: Total attenuation between the unit and Signal Analyzer
    - Reference level: 0 dBm
5. Apply power to the unit and record peak power output value for Mode A interrogation
6. Configure the Signal Analyzer as per below settings
    - Center frequency: 1030 MHz
    - Span: 8 MHz
    - Resolution bandwidth: 2 MHz
    - Video bandwidth: 8 MHz
    - Sweep time: 1 second
    - Trace/Max hold: ON
    - Reference level offset: Total attenuation between the unit and Signal Analyzer
    - Reference level: 0 dBm

7. Record the Mode A interrogation frequency value
8. Repeat steps 4 through 7 at -45°C, -40°C, -30°C, -20°C, -10°C, 0°C, +10°C, +20°C, +30°C, +40°C, +50°C, +60°C, and +70°C.

9.7.1.2.4 Frequency Stability (Temperature Variation) Test Results

Mode A interrogation frequency and the peak power output values recorded during the temperature variation test are tabulated in Table 9-21

Table 9-21: Frequency Stability (Temperature Variation) Test Results

NGT-2500 Mode A Interrogation			Limits	
Temp Deg C	**Power Output (dBm)**	**Measured Frequency (MHz)**	**Power Output**	**Frequency**
-45	-8.835	1030.020	-3dBm to -18dBm	1030 ± 0.1MHz
-40	-9.200	1029.990	-3dBm to -18dBm	1030 ± 0.1MHz
-30	-10.229	1029.995	-3dBm to -18dBm	1030 ± 0.1MHz
-20	-11.346	1029.960	-3dBm to -18dBm	1030 ± 0.1MHz
-10	-12.029	1030.005	-3dBm to -18dBm	1030 ± 0.1MHz
0	-12.896	1029.990	-3dBm to -18dBm	1030 ± 0.1MHz
10	-13.794	1030.025	-3dBm to -18dBm	1030 ± 0.1MHz
20	-14.505	1029.980	-3dBm to -18dBm	1030 ± 0.1MHz
30	-15.418	1029.970	-3dBm to -18dBm	1030 ± 0.1MHz
40	-16.295	1029.990	-3dBm to -18dBm	1030 ± 0.1MHz
50	-17.034	1029.990	-3dBm to -18dBm	1030 ± 0.1MHz
60	-17.520	1030.040	-3dBm to -18dBm	1030 ± 0.1MHz
70	-17.922	1029.975	-3dBm to -18dBm	1030 ± 0.1MHz

9.7.2 Frequency Stability (Primary Power Variation)

47CFR references:
2.1055, Frequency Stability
15.31, Measurement Standards
87.133, Frequency Stability

47CFR15.31 (e) states that measurements of the radiated signal level of the fundamental frequency component of the emission shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

For the 14 VDC power, 85%/115% = 11.9 VDC/16.1 VDC will be used
For the 28 VDC power, 85%/115% = 23.8 VDC/32.2 VDC will be used

9.7.2.1 UAT Transmission

9.7.2.1.1 Frequency Stability (Primary Power Variation) Test Equipment Required

Table 9-22: Frequency Stability (Primary Power Variation) Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Variable Attenuator (or	Fairview	SA35110

Equipment/Application	Manufacturer	Model
Equivalent)	Microwave	
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.7.2.1.2 Frequency Stability (Primary Power Variation) Test Setup

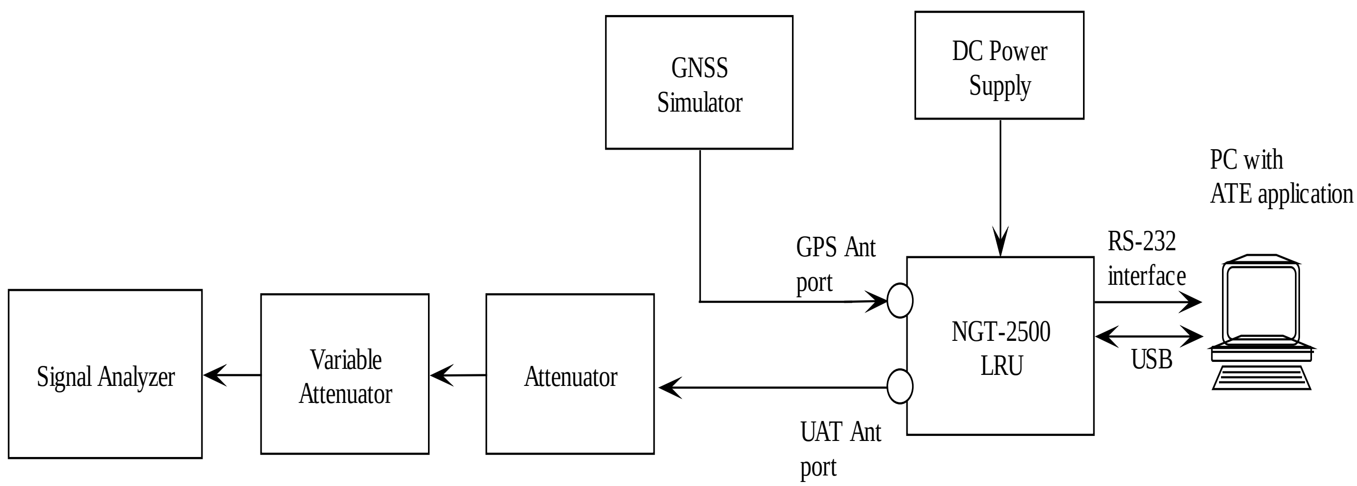


Figure 9-26: Frequency Stability (Primary Power Variation) Test Setup for UAT Transmission

9.7.2.1.3 Frequency Stability (Primary Power Variation) Test Procedure

1. Connect the equipment as shown in Figure 9-26 above.
2. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel
3. Adjust the variable attenuator such that 978 MHz signal power level at the input of Signal Analyzer is –40 ± 1 dBm (Total attenuation required between UAT antenna port of UUT and Signal Analyzer input: 87 dB approx.)
4. Apply +14 VDC power to the unit
5. Configure the Signal Analyzer as per the settings given in Table 9-6
6. Record the carrier offset value on Trace-4
7. Adjust the variable attenuator such that 978MHz signal power level at the input of Signal Analyzer is –6 ± 1 dBm (Total attenuation required between UAT antenna port of UUT and Signal Analyzer input: 53 dB approx.)
8. Configure the Signal Analyzer as per below settings
    - Center frequency: 978 MHz
    - Span: 0 Hz
    - Resolution bandwidth: 2 MHz
    - Video bandwidth: 6 MHz
    - Sweep time: 1 ms
    - Trigger type: Video
    - Trigger delay: -250 us

- Trace/Max hold: ON
- Continuous peak search: ON
- Reference level offset: Total attenuation between the unit and Signal Analyzer
- Reference level: +55 dBm

9. Record peak output power for UAT transmission
10. Repeat steps 5 through 9 for +11.9 VDC, +16.1 VDC, +23.8 VDC, +28 VDC and +32.2 VDC
11. To calculate UAT transmission frequency, add the measured carrier offset value to 978MHz.

9.7.2.1.4 Frequency Stability (Primary Power Variation) Test Results

The transmission frequency offset and the peak power output values recorded during the primary power variation test are tabulated in Table 9-25

Table 9-23: Frequency Stability (Primary Power variation) Test Results

Frequency Stability (Primary Power Variation) of UAT Transmission			Limits	
Power Supply Voltage (V)	**Measured Power Output (dBm)**	**Measured Frequency (MHz)**	**Power Output**	**Frequency**
11.9	+47.013	977.9993146	+44dBm to +48dBm	978MHz ± 19.56kHz
14	+47.033	977.9992776	+44dBm to +48dBm	978MHz ± 19.56kHz
16.1	+47.027	977.9992026	+44dBm to +48dBm	978MHz ± 19.56kHz
23.8	+47.002	977.9992324	+44dBm to +48dBm	978MHz ± 19.56kHz
28	+46.987	977.9990771	+44dBm to +48dBm	978MHz ± 19.56kHz
32.2	+46.849	977.9989424	+44dBm to +48dBm	978MHz ± 19.56kHz

9.7.2.2 Mode A Interrogation

9.7.2.2.1 Frequency Stability (Primary Power Variation) Test Equipment Required

Table 9-24: Frequency Stability (Primary Power Variation) Test Equipment Required

Equipment/Application	Manufacturer	Model
NGT-2500 LRU	ACSS	9022500-10000
Circulator	Renaissance Communications Private Limited	A2NN
Attenuator (or Equivalent)	Mini Circuits	BW-S20W20+
Tunable Band Pass Filter (Tuned to 1030MHz)	Telonic Berkeley Inc.	TTF 1000
Signal Analyzer	Agilent	N9020A
GNSS Simulator	Accord	ACC_SIM_04
DC Power Supply	Aplab	L6403
ATE Application	Accord	ATE-APP-2.20

Comment: Equivalent equipment may be used.

9.7.2.2.2 Frequency Stability (Primary Power Variation) Test Setup

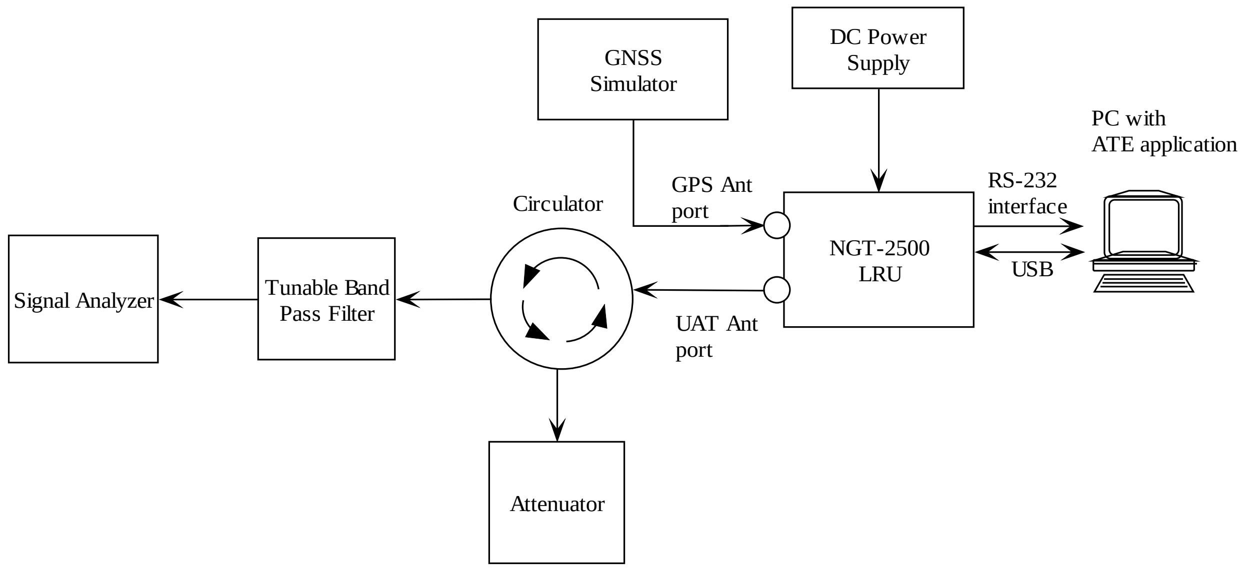


Figure 9-27: Frequency Stability (Primary Power Variation) Test Setup for Mode A Interrogation

9.7.2.2.3 Frequency Stability (Primary Power Variation) Test Procedure

1. Connect the equipment as shown in Figure 9-27 above.
2. Configure the NGT-2500 unit to transmit one long message per second with valid payload data using ATE application and control panel
3. Apply +14 VDC power to the unit
4. Configure the Signal Analyzer as per below settings
    - Center frequency: 1030 MHz
    - Span: 0 Hz
    - Resolution bandwidth: 8 MHz
    - Video bandwidth: 50 MHz
    - Sweep time: 20 us
    - Trigger type: Video
    - Trigger delay: -5 us
    - Trace/Max hold: ON
    - Continuous peak search: ON
    - Reference level offset: Total attenuation between the unit and Signal Analyzer
    - Reference level: 0 dBm
5. Record peak power output value for Mode A interrogation
6. Configure the Signal Analyzer as per below settings
    - Center frequency: 1030 MHz
    - Span: 8 MHz
    - Resolution bandwidth: 2 MHz
    - Video bandwidth: 8 MHz
    - Sweep time: 1 second
    - Trace/Max hold: ON
    - Reference level offset: Total attenuation between the unit and Signal Analyzer
    - Reference level: 0 dBm

7. Record the Mode A interrogation frequency value
8. Repeat steps 4 through 7 for +11.9 VDC, +16.1 VDC, +23.8 VDC, +28 VDC and +32.2 VDC

9.7.2.2.4 Frequency Stability (Primary Power Variation) Test Results

Mode A interrogation frequency and the peak power output values recorded during the temperature variation test are tabulated in Table 9-25

Table 9-25: Frequency Stability (Primary Power variation) Test Results

Frequency Stability (Primary Power Variation) of Mode A Interrogation			Limits	
Power Supply Voltage (V)	**Measured Power Output (dBm)**	**Measured Frequency (MHz)**	**Power Output**	**Frequency**
11.9	-16.123	1029.950	-3dBm to -18dBm	1030 ± 0.1MHz
14	-16.129	1030.005	-3dBm to -18dBm	1030 ± 0.1MHz
16.1	-16.115	1030.000	-3dBm to -18dBm	1030 ± 0.1MHz
23.8	-16.14	1029.990	-3dBm to -18dBm	1030 ± 0.1MHz
28	-16.163	1029.995	-3dBm to -18dBm	1030 ± 0.1MHz
32.2	-16.175	1029.985	-3dBm to -18dBm	1030 ± 0.1MHz

APPENDIX A DNB TEST DATA – COALVILLE, UTAH

Appendix A

DNB Test Results - Coalville, Utah

FCC Part 2, Part 15, Part 87
Model NGT-2500

Foxit PDF Document

FCC Part 2, Part 15, Part 87

Test Report
for the

Transponder

Model # NGT-2500

Test Report Number UT58018A-002

Prepared For:
ACSS, an L-3 Communications & Thales Company
19810 N. 7th Avenue
Phoenix, AZ 85027

Prepared by:

DNB Engineering, Inc.
1100 E. Chalk Creek Road
Coalville, UT 84017

NIST

NVLAP

NVLAP Lab Code 200634-0

NEMKO Authorized

TABLE OF CONTENTS

DOCUMENT HISTORY

Revision	Number of Pages	Revised Pages	Description	Date
-001	All	All	Report Release	23 Sep 2014
-002	All	All	Add clarification to Section 5	9 Oct 2014

CERTIFICATION OF TEST DATA

This report, containing electromagnetic immunity and emissions test data and evaluations, has been prepared by an independent electromagnetic compatibility laboratory, DNB ENGINEERING, in accordance with the applicable specifications and instructions required per the Introduction. DNB Engineering has received accreditation to perform these tests by the following authorizations:

NEMKO EMC Laboratory Authorization No. ELA 116
NIST / NVLAP: Lab Code No: 200634-0

FCC Registration No. 90532

The data evaluation and equipment configuration presented herein are a true and accurate representation of the measurements of the test sample's electromagnetic immunity and emissions characteristics as of the dates and at the times of the test under the conditions herein specified.

Disclaimer: This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Report Prepared By:	Carrie Yates Administrative Assistant	20 Sep 2014 Date
Report Reviewed by:	CL Payne III Facility Manager	20 Sep 2014 Date
Revisiont Reviewed by:	CL Payne III Facility Manager	9 Oct 2014 Date

FCC Part 2, Part 15, Part 87 Test Completion Record for:

ACSS, an L-3 Communications & Thales Company: **Transponder**
Model # NGT-2500

Test Start Date: 15 Sep 2014 Test Completion Date: 16 Sep 2014

The EUT was tested in accordance with the requirements of the specifications and standards listed below and found to be fully compliant:

FCC 47 CFR Reference:
2.1051, Spurious Emissions at Antenna Terminals
2.1053, Field Strength of Spurious Radiation
15.109, Radiated Emission Limits
87.139, Emission Limitations

Conducted Spurious Emissions:	**Pass** ☒	**Fail** ☐	**N/A** ☐
Radiated Emissions Digital Devices:	**Pass** ☒	**Fail** ☐	**N/A** ☐
Field Strength of Spurious Radiation:	**Pass** ☒	**Fail** ☐	**N/A** ☐

1.0 INTRODUCTION

Electromagnetic Compatibility (EMC) tests were performed on a representative sample(s) of ACSS, an L-3 Communications & Thales Company, Transponder, Model # NGT-2500. The purpose of this test was to demonstrate compliance of the EUT with the applicable limits. The test results have been summarized herein, and all data sheets have been incorporated in Appendix C.

Where applicable, cables were routed consistent with the typical application by varying the configuration of the test sample. The effect of varying the position of cables was investigated to find the configuration that produced maximum emissions and susceptibility.

The EUT was evaluated to determine the “worst case” positioning of both cables and axis. Once the “worst case” configuration was determined care was used to maintain this configuration throughout the test.

2.0 DEVIATIONS

Deviations/Modifications to the EUT

NONE

Deviations/Modifications from the Test Standards

NONE

3.0 TEST SITE AND EQUIPMENT

The test equipment utilized in the performance of this test, along with current calibration information, is listed in the Test Equipment Log of Appendix A.

UNCERTAINTY TOLERANCE

DNB Engineering's Coalville Facility is within acceptable uncertainty tolerances per ANSI C63.4 (2009) sections 5.4.6.1 and 5.4.6.2 as well as CISPR 16-1(2002) Annex L, section L.2.

ANSI C63.4 (2009)

5.4.6.1 Site Attenuation. A measurement site shall be considered acceptable for radiated electromagnetic field measurements if the horizontal and vertical NSA derived from measurements, i.e., the "measured NSA," are within +/- 4 dB of the theoretical NSA (5.4.6.3) for an ideal site.

5.4.6.2 NSA Tolerance. The +/- 4 dB tolerance in 5.4.6.1 includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies. These errors are analyzed in ANSI C63.6- 1998 [3], wherein it is shown that the performance of a well-built site contributes only 1 db of the total allowable tolerance.

CISPR 16-1 (2002)

L.2 Error analysis

…The total estimated errors are the basis for the +/- 4 dB site acceptability criterions consisting of approximately 3 dB measurement uncertainty and an additional allowable 1 dB for site imperfections.

This uncertainty represents an expanded uncertainty
expressed at approximately the 95% confidence level using a coverage factor of k=2.

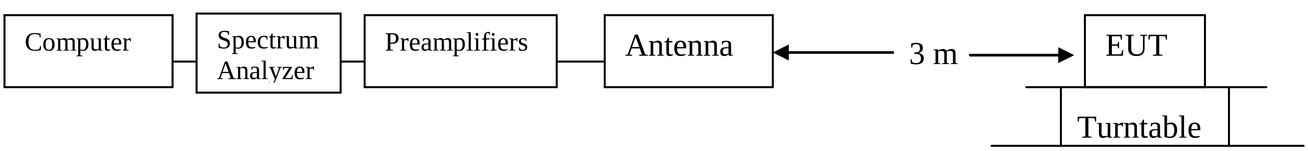
4.0 TEST DESCRIPTION

4.2 **Radiated RF Emissions** (ANSI C63.4 2009)

To measure radiated emissions, the EUT was set up on the 3 or 10-meter open air test site. The EUT is placed on a wooden table, which rests on a wooden turntable. The top of the table is one meter above the ground, and the turntable can be rotated 360 degrees. For each frequency measured, the antenna is raised and lowered for both horizontal and vertical polarities to obtain the maximum reading on the analyzer. The turntable is also rotated throughout the 360 degrees in azimuth to determine the position of the maximum emissions. The applicable frequency range is searched using the antennas listed below. The respective antenna and preamplifier were connected to an HP 8568B Spectrum Analyzer. Preamplifiers were used for all ranges to achieve the needed dynamic range. A list of the equipment used in this test is included in Appendix A. Photographs of this test set up are included in Appendix B.

Antenna(s):

Electro-Metrics 6505-A (.009 - 30 MHz) [ ]
SAS 200/540 BICONICAL (30 - 200 MHz) [X]
EMCO 3146 LOG PERIODIC (200 - 1000 MHz) [X]
EMCO 3115 DRG (1GHz – 18GHz) [X]
OTHER (See Equipment Log in Appendix B) [X]



5.0 CONCLUSIONS

The ACSS, an L-3 Communications & Thales Company, Transponder, Model #NGT-2500, was tested in accordance with the requirements listed herein. Pass/Fail status for each test is captured on page 5 along with test data in Appendix C. At the completion of testing the EUT and support equipment were returned to representatives of ACSS, an L-3 Communications & Thales Company.

APPENDIX A

Test Equipment Log

TEST EQUIPMENT LOG					
Description	Manufacturer/MN	Asset #	Serial #	Cal Due	Used On
Amplifier	HP/8447D	U-067	2727A06182	13-Jan-15	Radiated Emissions
Amplifier	HP/8447D	U-065	2727A06180	13-Jan-15	Radiated Emissions
Amplifier	HP/8447D	U-068	2727A06184	13-Jan-15	Radiated Emissions
Bicon Antenna	SCH/BBA9106	U-186	7	15-May-15	Radiated Emissions
Log P Antenna	SCH/UHAL09107	U-010	10	10-Sep-15	Radiated Emissions
Horn Antenna, DRG	AH Systems/SAS-571	U-071	417	11-Jun-15	Radiated Emissions
Spectrum Analyzer	Agilent/E7401A	U-257	MY42000103	8-Jan-16	Radiated Emissions
Spectrum Analyzer	R&S/FSV30	U-248	101367	24-Nov-14	Radiated Emissions
TILE Software	ETS- Lindgern/ 3.4.11.13	U-317	8112006	30-Sep-14	Radiated Emissions

APPENDIX B

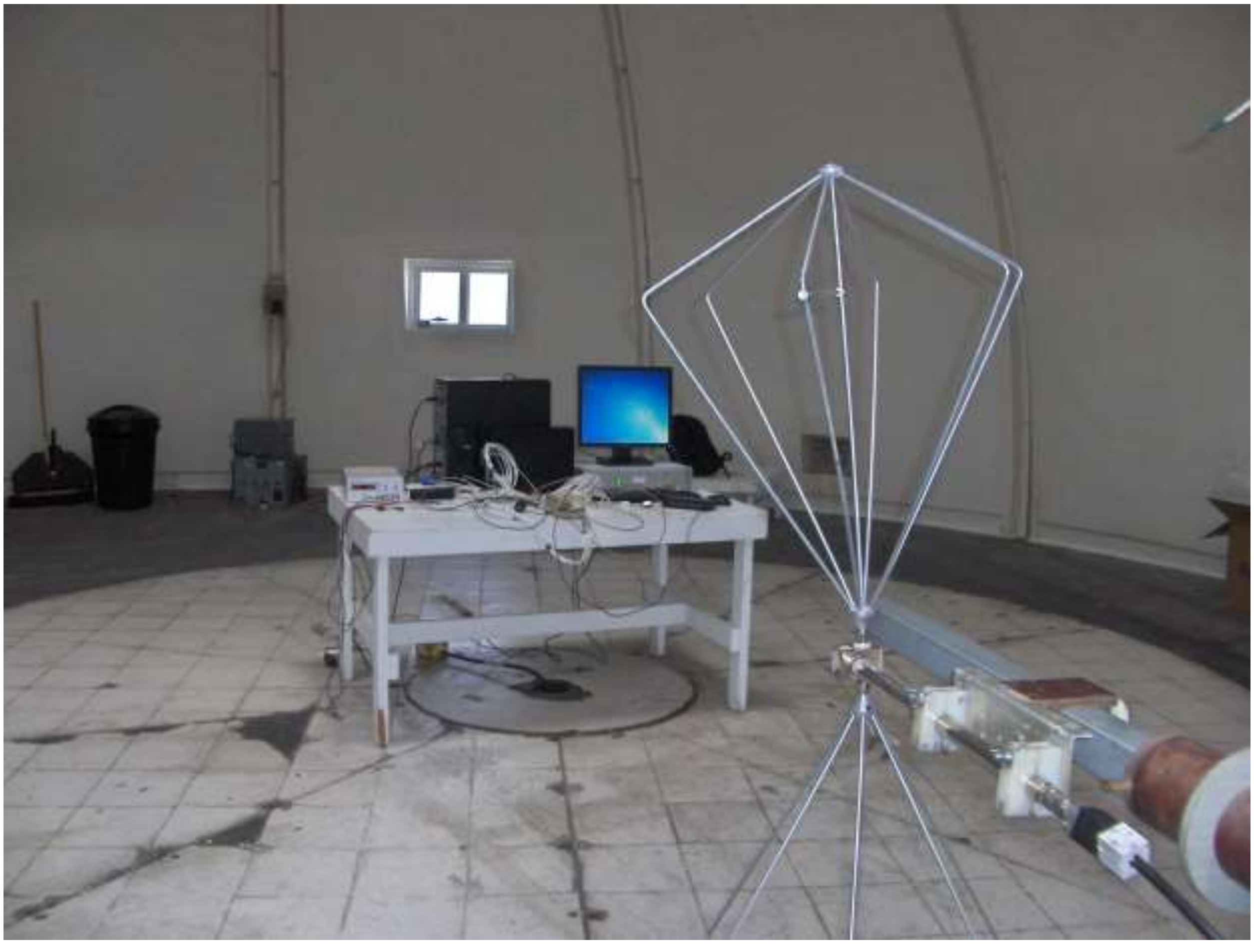
Photographs

Photos **Conducted Spurious**

Notes: 1GHz – 11GHz

Photos — Radiated Emissions-Bicon

Notes: 30MHz – 300 MHz



Photos Radiated Emissions – Log Periodic

Notes: 300MHz – 1000MHz

Photos Radiated Emissions - DRG

Notes: - 1GHz - 18GHz

APPENDIX C

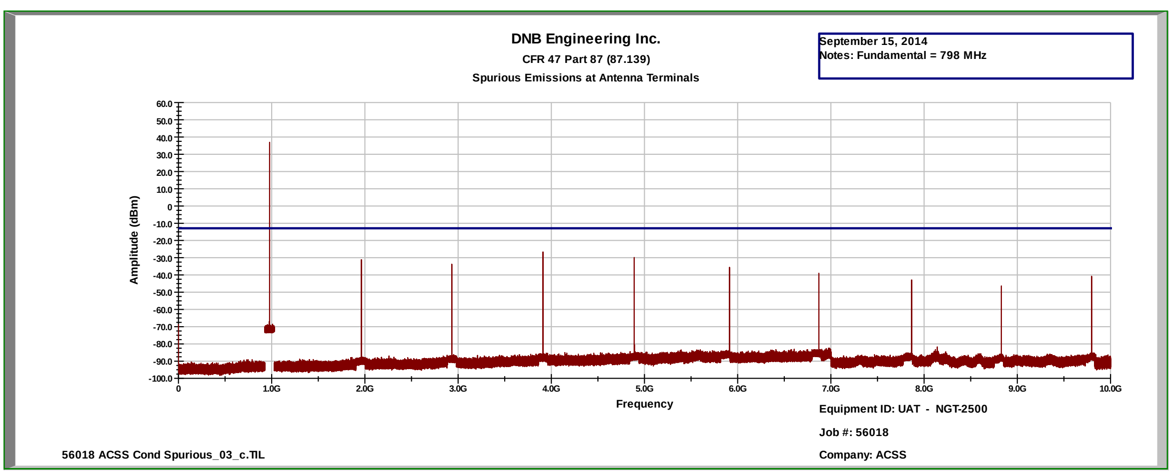
Test Data

Conducted Spurious Emissions

DNB Job Number:	UT58018A-001	Date: 15 Sep 2014	**Specification** FCC 47 CFR 2.1051 87.139
Customer:	ACSS, an L-3 Communications & Thales Company		
Model Number:	NGT-2500		
Description:	Transponder	S/N: N/A	
Test Equipment: (See pg. 11)	Asset #'s: U-248, U-317		

EUT performed within the requirements of the applicable Standard(s) YES ☒ NO ☐ SIGNED *CL Payne III*

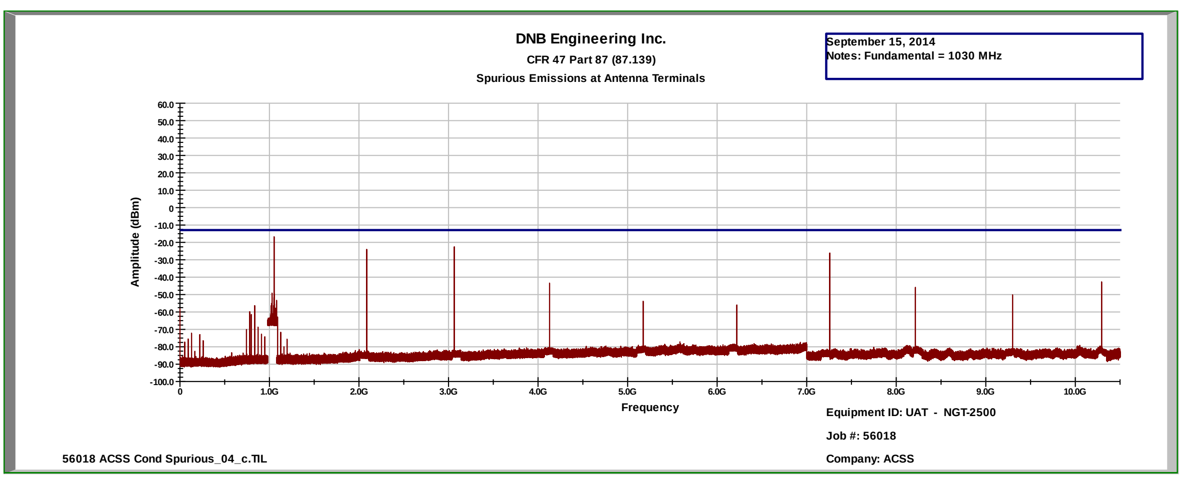
Freq in MHz	Meter (dBm)	Amp (dB)	Atten (dB)	Corr'd (dBm)	Limit (dBm)	Delta (dBm)
978	-17.21	0.00	54.12	36.91	Fund	N/A
1956	-87.40	0.00	56.15	-31.25	-13.00	-18.25
2934	-85.68	0.00	51.84	-33.84	-13.00	-20.84
3912	-77.25	0.00	50.47	-26.78	-13.00	-13.78
4890	-80.36	0.00	50.37	-29.99	-13.00	-16.99
5868	-83.41	0.00	47.73	-35.68	-13.00	-22.68
6846	-82.99	0.00	43.85	-39.14	-13.00	-26.14
7824	-85.27	0.00	42.28	-42.99	-13.00	-29.99
8802	-85.68	0.00	39.22	-46.46	-13.00	-33.46
9780	-84.10	0.00	43.21	-40.89	-13.00	-27.89



Conducted Spurious Emissions

DNB Job Number:	UT58018A-001	Date: 15 Sep 2014	**Specification** FCC 47 CFR 2.1051 87.139
Customer:	ACSS, an L-3 Communications & Thales Company		
Model Number:	NGT-2500		
Description:	Transponder	S/N: N/A	
Test Equipment: (See pg. 11)	Asset #'s: U-248, U-317		
EUT performed within the requirements of the applicable Standard(s) YES ☒ NO ☐ SIGNED *CL Payne III*			

Freq in MHz	Meter (dBm)	Amp (dB)	Atten (dB)	Corr'd (dBm)	Limit (dBm)	Delta (dBm)
1030	-46.23	0.00	29.35	-16.88	Fund	N/A
2060	-82.38	0.00	58.27	-24.11	-13.00	-11.11
3090	-81.99	0.00	59.39	-22.60	-13.00	-9.60
4120	-80.43	0.00	36.99	-43.44	-13.00	-30.44
5150	-78.79	0.00	24.87	-53.92	-13.00	-40.92
6180	-77.95	0.00	21.89	-56.06	-13.00	-43.06
7210	-81.45	0.00	55.24	-26.21	-13.00	-13.21
8240	-79.80	0.00	33.83	-45.97	-13.00	-32.97
9270	-81.01	0.00	30.77	-50.24	-13.00	-37.24
10300	-79.25	0.00	36.46	-42.79	-13.00	-29.79



1100 E Chalk Creek Road
Coalville, UT 84017
(435) 336-4433
FAX (435) 336-4436
www.dnbenginc.com

20 Sep 2014
UT58018A-002

Radiated Emissions Datasheet

DNB Job Number:	UT58018A-001	Date: 15 Sep 2014	**Specification** FCC 47 CFR 15.109 87.139
Customer:	ACSS, an L-3 Communications & Thales Company		
Model Number:	NGT-2500	Serial Number: N/A	
Description:	Transponder		
Test Equipment: (See pg. 11)	Asset #'s: U-010, U-065, U-186, U-248, U-317		
EUT performed within the requirements of the applicable Standard(s) YES ☒ NO ☐ SIGNED *CL Payne III*			

Freq. (MHz)	Meas'd (dBuV)	Amp Factors (dB)	Cable Factors (dB)	Antenna Factors (dB)	Corr'd (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (degree)	Height (m)	Hor/ Vert	Meas Type QP/Ave/Peak
34.887	40.28	26.50	1.90	16.80	32.48	40.45	-7.97	198	1.23	Vert	Peak
62.650	46.30	26.40	1.80	7.30	29.00	40.45	-11.45	201	1.00	Vert	Peak
116.337	48.63	26.30	2.10	11.80	36.23	40.45	-4.22	251	1.00	Vert	Peak
157.948	40.39	26.20	2.40	14.30	30.89	40.45	-9.56	354	1.00	Vert	Peak
160.563	39.55	26.10	2.50	14.70	30.65	40.45	-9.80	0	1.00	Vert	Peak
160.579	42.60	26.10	2.50	14.70	33.70	40.45	-6.75	126	1.53	Hor/	Peak
186.461	38.97	26.00	2.80	16.70	32.47	40.45	-7.98	327	1.00	Vert	Peak
186.450	41.45	26.00	2.80	16.70	34.95	40.45	-5.50	318	1.00	Hor/	Peak
192.010	42.17	25.90	2.80	17.60	36.67	40.45	-3.78	292	1.00	Vert	QP
191.985	41.75	25.90	2.80	17.60	36.25	40.45	-4.20	278	1.00	Hor/	Peak
221.192	40.27	26.00	2.90	16.60	33.77	40.45	-6.68	239	1.00	Vert	Peak
221.189	44.95	26.00	2.90	16.60	38.45	40.45	-2.00	349	1.29	Hor/	QP
249.996	39.61	26.00	2.90	16.80	33.31	47.45	-14.14	344	1.00	Vert	Peak
270.354	39.80	25.80	3.50	19.00	36.50	47.45	-10.95	326	1.00	Vert	QP
270.328	45.09	25.80	3.50	19.00	41.79	47.45	-5.66	339	1.08	Hor/	QP
308.600	31.00	25.90	3.80	17.60	26.50	47.45	-20.95	257	1.63	Vert	QP
418.000	30.97	26.70	4.50	17.90	26.67	47.45	-20.78	141	1.00	Hor/	QP
503.100	25.67	27.20	5.20	19.80	23.47	47.45	-23.98	237	2.71	Hor/	QP
539.600	23.86	27.30	5.30	20.40	22.26	47.45	-25.19	210	1.60	Vert	QP
308.600	38.70	25.90	3.80	17.60	34.20	47.45	-13.25	268	1.00	Hor/	QP

Field Strength of Radiated Spurious

DNB Job Number:	UT58018A-001	Date: 15 Sep 2014	**Specification** FCC 47 CFR 2.1053 15.109 87.139
Customer:	ACSS, an L-3 Communications & Thales Company		
Model Number:	NGT-2500	Serial Number: N/A	
Description:	Transponder		
Test Equipment: (See pg. 11)	Asset #'s: U-010, U-071, U-248, U-317		

EUT performed within the requirements of the applicable Standard(s) YES ☒ NO ☐ SIGNED *CL Payne III*

Vertical Fundamental = -13.37dBm @ 978MHz
Horizontal Fundament = -13.32dBm @ 978 MHz

Freq (MHz)	Meas'd (dBuV)	Cable Factors (dB)	Antenna Factors (dB)	Corrected (dBuV/m)	Azimuth (degree)	Height (m)	Hor Vert	Meas Type Ave / PK	Substitution Method (dBm)	30dBc Limit	Delta
1956	5.17	2.82	28.08	36.07	339	1.00	Vert	Ave	-59.48	-43.37	-16.11
2934	3.39	3.41	30.22	37.02	10	1.00	Vert	Ave	-58.21	-43.37	-14.84
3912	4.82	4.90	31.70	41.42	355	1.18	Vert	Ave	-54.81	-43.37	-11.44
4890	5.31	7.89	33.30	46.50	8	1.00	Vert	Ave	-49.26	-43.37	-5.89
5868	3.25	9.83	34.83	47.91	316	1.19	Vert	Ave	-48.57	-43.37	-5.20
6846	3.32	8.31	36.87	48.50	320	1.80	Vert	Ave	-47.91	-43.37	-4.54
7824	-1.57	7.86	37.13	43.42	330	1.33	Vert	Ave	-51.82	-43.37	-8.45
8802	-1.89	6.84	37.52	42.47	182	1.00	Vert	Ave	-52.75	-43.37	-9.38
9780	-1.45	5.76	37.91	42.22	128	1.00	Vert	Ave	-53.59	-43.37	-10.22
1956	5.47	2.82	28.08	36.37	51	2.12	Hor	Ave	-59.86	-43.32	-16.54
2934	3.40	3.41	30.22	37.03	27	1.00	Hor	Ave	-58.46	-43.32	-15.14
3912	4.73	4.90	31.70	41.33	0	1.40	Hor	Ave	-52.87	-43.32	-9.55
4890	5.28	7.89	33.30	46.47	360	1.00	Hor	Ave	-49.58	-43.32	-6.26
5868	3.13	9.83	34.83	47.79	212	3.90	Hor	Ave	-48.55	-43.32	-5.23
6846	3.02	8.31	37.18	48.50	353	3.71	Hor	Ave	-47.86	-43.32	-4.54
7824	-1.57	7.86	37.13	43.42	161	1.00	Hor	Ave	-52.86	-43.32	-9.54
8802	-1.90	6.84	37.52	42.46	346	3.08	Hor	Ave	-53.88	-43.32	-10.56
9780	-1.48	5.76	37.91	42.19	350	1.16	Hor	Ave	-54.15	-43.32	-10.83

Field Strength of Radiated Spurious

DNB Job Number:	UT58018A-001	Date: 15 Sep 2014	**Specification** FCC 47 CFR 2.1053 15.109 87.139
Customer:	ACSS, an L-3 Communications & Thales Company		
Model Number:	NGT-2500	Serial Number: N/A	
Description:	Transponder		
Test Equipment: (See pg. 11)	Asset #'s: U-071, U-248, U-317		
EUT performed within the requirements of the applicable Standard(s) YES ☒ NO ☐ SIGNED *CL Payne III*			

Freq (MHz)	Meas'd (dBuV)	Amp Factors (dB)	Cable Factors (dB)	Antenna Factors (dB)	Total (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (degree)	Height (m)	Hor Vert	Meas Type Ave / PK
2060	2.17	0.00	2.88	28.56	33.61	54.00	-20.39	129	1.76	Vert	Ave
3090	3.22	0.00	3.42	30.30	36.94	54.00	-17.06	105	1.27	Vert	Ave
4120	4.55	0.00	5.75	31.98	42.28	54.00	-11.72	98	2.51	Vert	Ave
5150	6.22	0.00	8.66	33.73	48.61	54.00	-5.39	20	1.53	Vert	Ave
6180	3.67	0.00	9.45	35.45	48.57	54.00	-5.43	64	2.12	Vert	Ave
7210	-1.73	0.00	8.29	37.17	43.74	54.00	-10.26	277	4.00	Vert	Ave
8240	-1.74	0.00	7.45	37.30	43.00	54.00	-11.00	0	1.00	Vert	Ave
9270	-1.53	0.00	5.75	37.71	41.93	54.00	-12.07	289	3.74	Vert	Ave
10300	-1.51	0.00	5.84	38.48	42.81	54.00	-11.19	0	1.00	Vert	Ave
2060	2.19	0.00	2.88	28.56	33.63	54.00	-20.37	133	1.50	Hor	Ave
3090	3.25	0.00	3.42	30.30	36.97	54.00	-17.03	0	2.04	Hor	Ave
4120	4.58	0.00	5.75	31.98	42.31	54.00	-11.69	270	2.10	Hor	Ave
5150	6.28	0.00	8.66	33.73	48.67	54.00	-5.33	348	3.81	Hor	Ave
6180	3.64	0.00	9.45	35.81	48.90	54.00	-5.10	64	4.00	Hor	Ave
7210	-1.73	0.00	8.29	37.17	43.74	54.00	-10.26	176	3.75	Hor	Ave
8240	-1.81	0.00	7.45	37.30	42.93	54.00	-11.07	0	1.78	Hor	Ave
9270	-1.15	0.00	5.75	37.71	42.31	54.00	-11.69	235	3.35	Hor	Ave
10300	-1.56	0.00	5.84	38.48	42.76	54.00	-11.24	360	1.40	Hor	Ave

End of Report: DNB UT58018A-002

END OF DOCUMENT