ENGINEERING TEST REPORT

Hand Held Point of Sale Device
Model No.: NURIT 8000S
FCC ID: O2SNURIT8000SWD

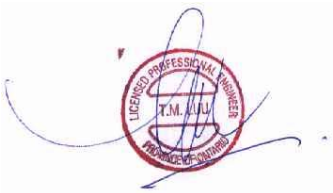
Applicant:

Lipman USA, Inc.
50 Gordon Dr.
Syosset, NY
USA, 11791

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, PARTS 2 and 90 (Subpart I)

UltraTech's File No.: LEE-012FCC90

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: March 29, 2004	
Report Prepared by: Anca Dobre Issued Date: March 29, 2004	Tested by: Mr.Hung Trinh, RFI Technician Test Dates: March 10 - 16, 2004

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	▪ Exhibit 1: Submittal check lists ▪ Exhibit 2: Introduction ▪ Exhibit 3: Performance Assessment ▪ Exhibit 4: EUT Operation and Configuration during Tests ▪ Exhibit 5: Summary of test Results ▪ Exhibit 6: Measurement Data ▪ Exhibit 7: Measurement Uncertainty ▪ Exhibit 8: Measurement Methods	OK
1	Test Setup Photos	Radiated Emissions Setup Photos	OK
2	External EUT Photos	External Photos	OK
3	Internal EUT Photos	Internal Photos	OK
4	Cover Letters	▪ Letter from Ultratech for Certification Request ▪ Letter from the Applicant to appoint Ultratech to act as an agent ▪ Letter from the Applicant to request for Confidentiality Filing	OK
5	Attestation Statements	Part 90.203(e)	OK
6	ID Label/Location Info	▪ ID Label ▪ Location of ID Label	OK
7	Block Diagrams	Block Diagram	OK
8	Schematic Diagrams	Schematics	OK
9	Parts List/Tune Up Info	Parts List of Module	OK
10	Operational Description	System Description	OK
11	RF Exposure Info	See SAR Test Reports for Details	OK
12	Users Manual	User Manual	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 90
Title:	Code of Federal Regulations (CFR), Title 47 - Telecommunication, Parts 2 & 90
Purpose of Test:	To obtain FCC Certification Authorization for Radio operating in the Frequency Bands 806-821 MHz (25 kHz Channel Spacing) and 821-824 MHz (12.5kHz Channel Spacing).
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with TIA/EIA Standard TIA/EIA-603 (01-Nov-2002) – Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

2.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2003	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
TIA/EIA 603, Edition B	01-Nov-2002	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Lipman USA, Inc.
Address:	50 Gordon Dr. Syosset, NY 11791 USA
Contact Person:	Mr. Bulent Ozayaz Phone #: (516) 484-9898 Fax #: (516) 484-9057 Email: bulent@lipmanusa.com

MANUFACTURER	
Name:	Lipman Electronics Engineering Ltd.
Address:	11 Haamal Street Park Afek Rosh-Haayin 48092 Israel
Contact Person:	Mr.Avi Galili Phone #: 972-3-9029730 Fax #: 972-3-9029731 Email Address: avi@lipman.co.il

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Nurit
Product Name:	Hand Held Point of Sale Device
Model Name or Number:	NURIT 8000S
Type of Equipment:	Licensed Non-broadcast Radio Communication Equipment
Power Supply:	Lipman Li-ion Battery Pack Model No.: BAT09501-M01-GRY
Transmitting/Receiving Antenna Type:	Integral
Primary User Functions of EUT:	Wireless hand held POS/EDC terminal for credit, debit and ERT transactions

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	7.4 V Li-ion battery pack
RF Output Power Rating:	• 2.0 Watts max. • 0.5 Watts min.
Operating Frequency Range:	806-821 MHz and 821-824 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	• 25 kHz for 806-821 MHz • 12.5 kHz for 821-824 MHz
Data Rate	• 19.2 kb/s for 806-821 MHz • 9.6 kb/s for 821-824 MHz
Occupied Bandwidth (99%):	• 16.07 kHz (for 25 kHz Channel Spacing) • 11.66 kHz (for 12.5 kHz Channel Spacing)
Modulation Type:	• 4-Level FSK RDLAP 9.6 kb/s, 3.9 kHz Frequency Deviation (12.5 kHz Channel Spacing) • 4-Level FSK RDLAP 19.2 kb/s, 5.6 kHz Frequency Deviation (25 kHz Channel Spacing)
Emission Designation*:	• 20K8F1D for 806-824 MHz • 12K6F1D for 821-824 MHz
Antenna Connector Type:	Integral
Antenna Description:	Manufacturer: Mars Antennas & RF System Ltd. Type: Embedded Model: MA8087-1VOMDTL Frequency Range: TX: 806-825 MHz, RX: 851-870 MHz In/Out Impedance: 50 Ohms Gain: -1 dBi

* For an average case of commercial telephony, the Necessary Bandwidth is calculated as follows:

For FM Digital Modulation:

(a) 821-824 MHz Band, Channel Spacing = 12.5 KHz, D = 3.9 KHz max, K = 1, Level of FM = 4
M = Data Rate in kb/s / Level of FM = 9.6/4 kb/s
B_n = 2M + 2DK = 2(9.6/4) + 2(3.9)(1) = **12.6 KHz**

Emission designation: 12K6F1D

(b) 806-821 MHz Band, Channel Spacing = 25 KHz, D = 5.6 KHz max, K = 1, Level of FM = 4
M = Data Rate in kb/s / Level of FM = 19.2/4 kb/s
B_n = 2M + 2DK = 2(19.2/4) + 2(5.6)(1) = **20.8 KHz**

Emission designation: 20K8F1D

3.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Data I/O	1	HRS-3260-10S	Shielded
2	Power	1	Miniature Power	Non-shielded

EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	7.4 V Li-ion Battery Pack

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	Software provided by Lipman to configure the unit for testing purposes.
Special Hardware Used:	N/A
Transmitter Test Antenna:	Integral part of the EUT

Transmitter Test Signals	
Frequency Band(s):	• 806-821 MHz • 821-824 MHz
Frequency(ies) Tested:	• 806, 813.5 and 821 MHz • 821 and 824 MHz
Transmitter Wanted Output Test Signals:	
• RF Power Output (measured maximum output power):	• 2 Watts max.
• Normal Test Modulation:	• Level 4 – FSK at maximum data rate of 19.2 kb/s for 25 kHz Channel Spacing and 9.6 kb/s for 12.5 kHz Channel Spacing.
• Modulating signal source:	• Internal

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: February 17, 2004.

5.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
90.205 & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes (see Note 1)
90.213 & 2.1055	Frequency Stability	Yes (see Note 2)
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	N/A
90.210 & 2.1047(b)	Modulation Limiting	Yes (see Note 2)
90.210 & 2.1049	Emission Limitation & Emission Mask	Yes
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes (see Note 2)
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
Hand Held Point of Sale Device, Model No: NURIT 8000S, by Lipman Electronics Engineering Ltd., has also been tested and found to comply with FCC Part 15, Subpart B – Class B Digital Devices. The engineering test report has been documented and kept on file and it is available upon request.		

Note 1: Refer to SAR test report for details.

Note 2: Since, there is no change in RF characteristic, circuitry and functional capabilities in the Wavenet Technology Pty Ltd. Boomer III Data TAC Wireless OEM Modem Module (FCC ID: PQS-BM3800D) approved as a Modular Transceiver, tests are not required to be repeated. Please refer to Wavenet Technology Pty Ltd.Test Report for further details.

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

5.4. DEVIATION FROM STANDARD TEST PROCEDURES

None.

EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report.

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4: 2003 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

6.5. RF POWER OUTPUT [§§ 2.1046 & 90.205]

6.5.1. Limits

Please refer to FCC 47 CFR 90.205 for specification details.

6.5.2. Method of Measurements

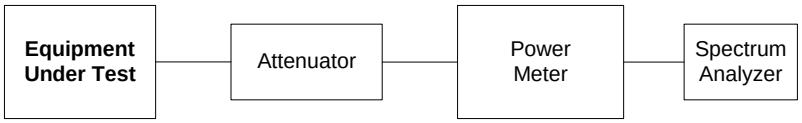
Refer to Exhibit 8, Section 8.1 (Conducted) and 8.2 (Radiated) of this report for measurement details

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	Hewlett Packard	436A	2709A27515	10 kHz – 50 GHz, sensor dependent
Spectrum Analyzer	Advantest	R3271	15050203	10 MHz – 26.5 GHz
Attenuator	Weinschel Corp	46-20-34	BM1347	DC – 18 GHz

6.5.4. Test Arrangement

Power at RF Power Output Terminals



6.5.5. Test Data

6.5.5.1. Operation in 806 – 821 MHz, 25 kHz Channel Spacing, Level 4 FSK, Max Data Rate: 19.2 kb/s

RF Output Power Settings	Fundamental Frequency (MHz)	Measured (Peak) Power (dBm)	Power Rating (dBm)
High	806	33.11	33
	813.5	33.03	33
	821	32.99	33

6.5.5.2. Operation in 821 – 824 MHz, 12.5 kHz Channel Spacing, Level 4 FSK, Max Data Rate: 9.6 kb/s

RF Output Power Settings	Fundamental Frequency (MHz)	Measured (Peak) Power (dBm)	Power Rating (dBm)
High	821	32.99	33
	824	32.97	33

6.6. OCCUPIED BANDWIDTH & EMISSION MASK [§§ 2.1049, 90.209 & 90.210]

6.6.1. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

Frequency Range (MHz)	Authorized BW (KHz)	Channel Spacing (KHz)	Recommended Max. Frequency Deviation (KHz)	FCC Applicable Mask
806-821	20	25	5	Mask G - Data
821-824	20	12.5	2.5	Mask H - Data

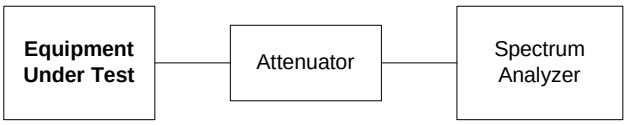
6.6.2. Method of Measurements

Refer to Exhibit 8, Section 8.3 of this report for measurement details

6.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Advantest	R3271	15050203	9kHz – 40GHz
Attenuator	Weinschel Corp	46-20-34	BM1347	DC – 18 GHz

6.6.4. Test Arrangement



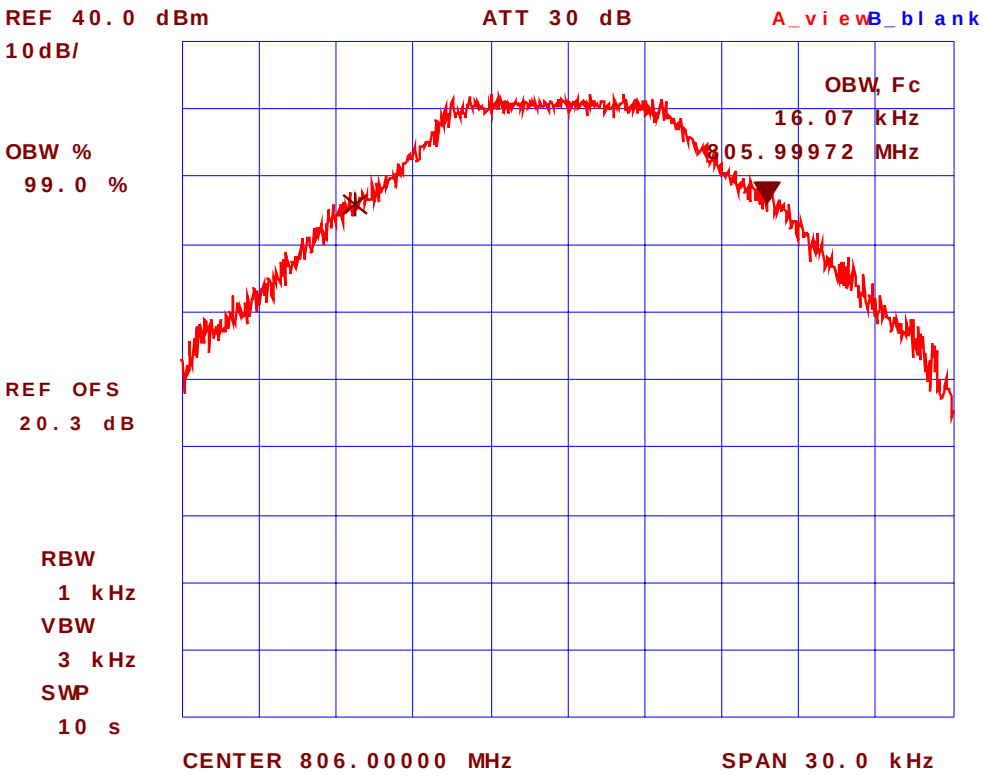
6.6.5. Test Data

6.6.5.1. 99% Occupied Bandwidth

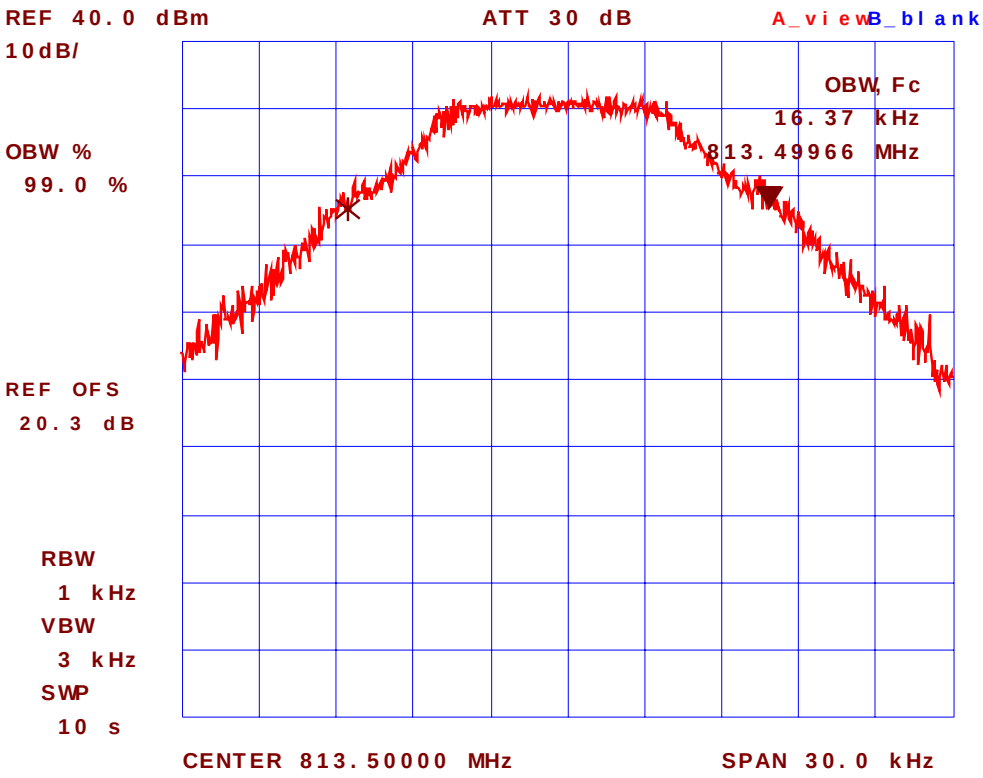
Frequency (MHz)	Channel Spacing (kHz)	*Measured 99% OBW (kHz)	Calculated Necessary Bandwidth based on maximum frequency deviation
806.0	25	16.07	20.8
813.5	25	16.37	20.8
821.0	25	16.67	20.8
821.0	12.5	11.66	12.6
824.0	12.5	12.00	12.6

*See plot # 1 to 5 for details of measurements.

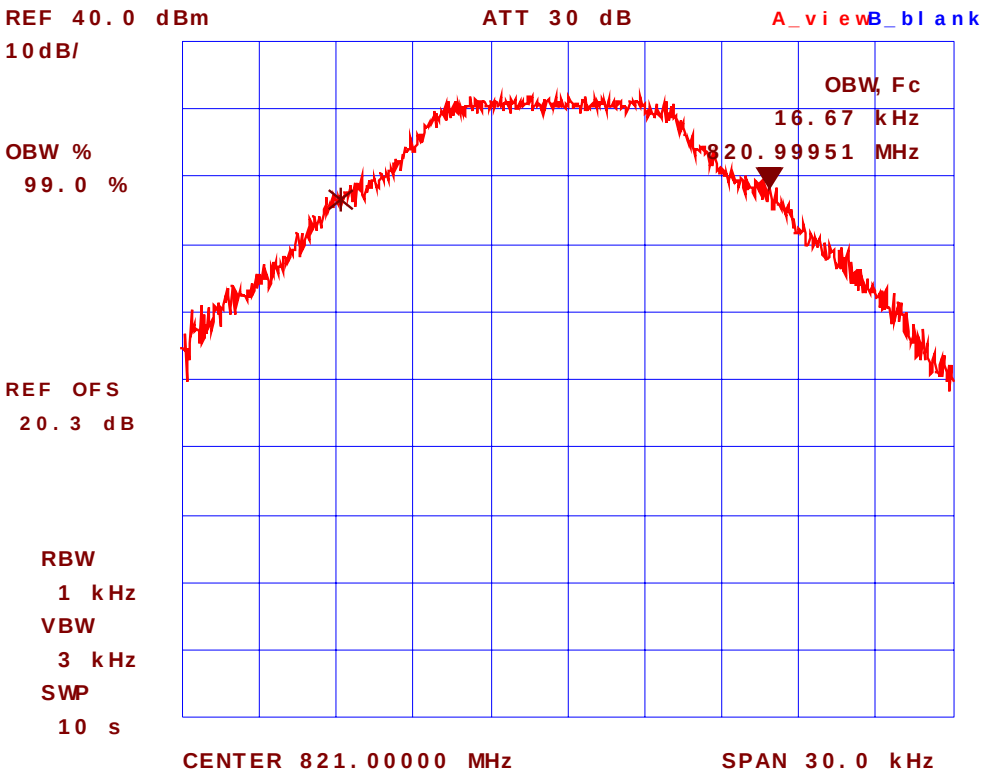
Plot # 1:
99% Occupied Bandwidth
Test Frequency: 806 MHz, Modulation: 4-Level FSK RDLAP 19.2 kbps
25 Channel Spacing



Plot # 2:
99% Occupied Bandwidth
Test Frequency: 813.5 MHz, Modulation: 4-Level FSK RDLAP 19.2kbps
25 kHz Channel Spacing

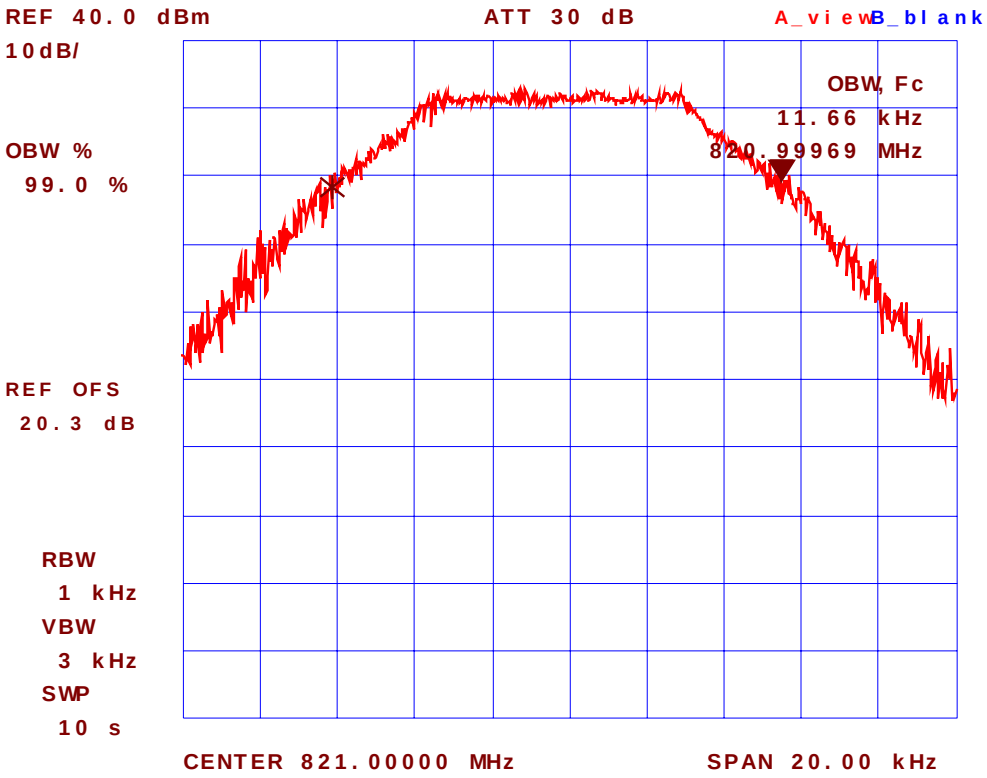


Plot # 3:
99% Occupied Bandwidth
Test Frequency: 821 MHz, Modulation: 4-Level FSK RDLAP 19.2kbps
25 kHz Channel Spacing

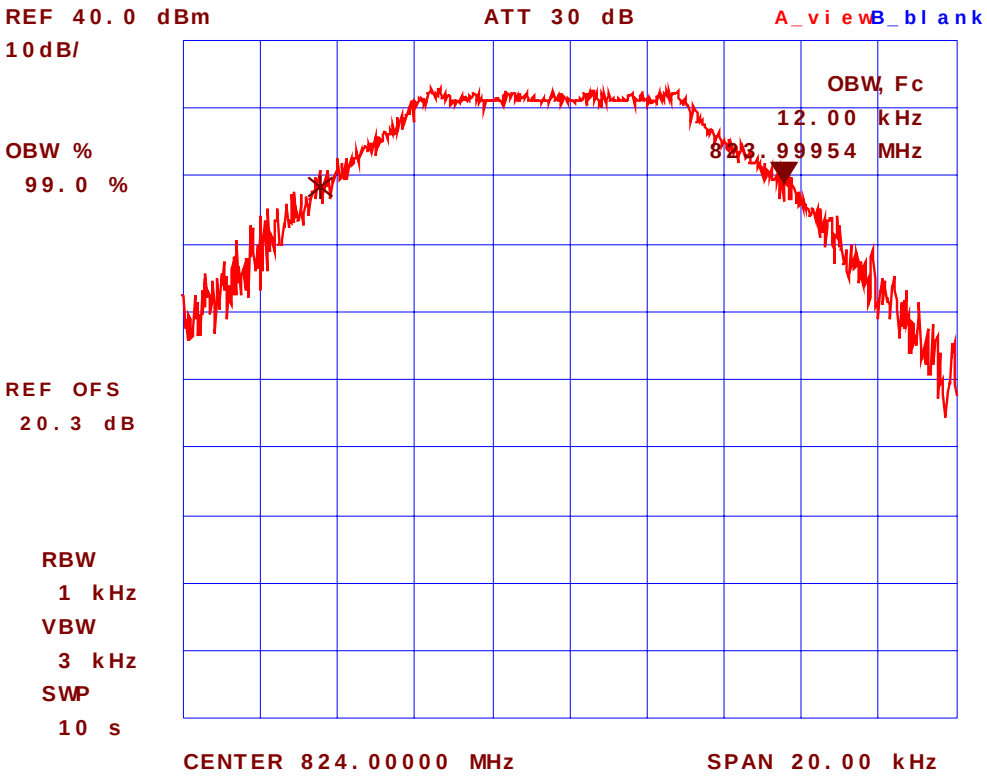


All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot # 4:
99% Occupied Bandwidth
Test Frequency: 821 MHz, Modulation: 4-Level FSK RDLAP 9.6 kbps
12.5 kHz Channel Spacing



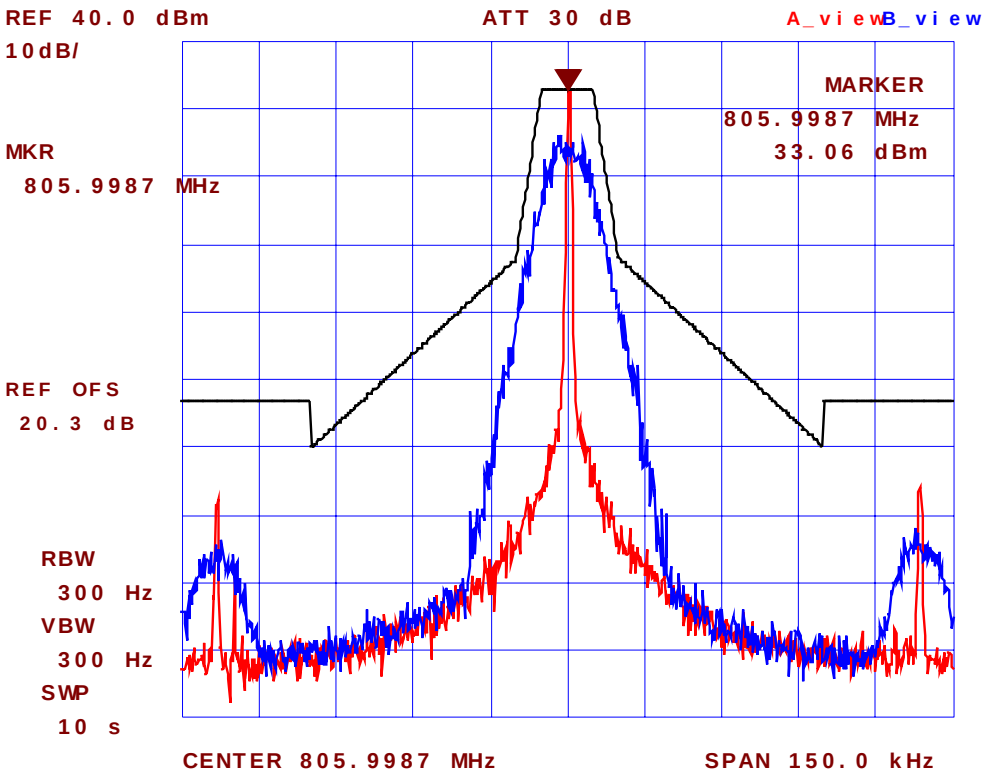
Plot # 5:
99% Occupied Bandwidth
Test Frequency: 824 MHz, Modulation: 4-Level FSK RDLAP 9.6 kbps
12.5 kHz Channel Spacing



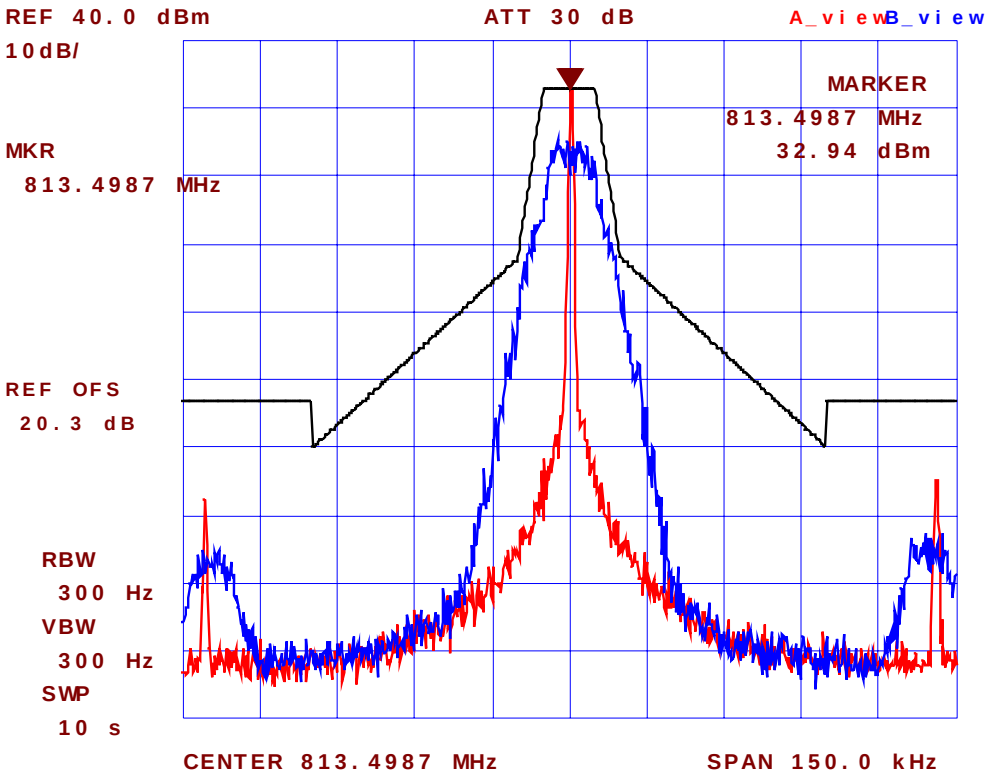
6.6.5.2. Emission Masks

Conform. See the following test data plots (6 through 10) for details.

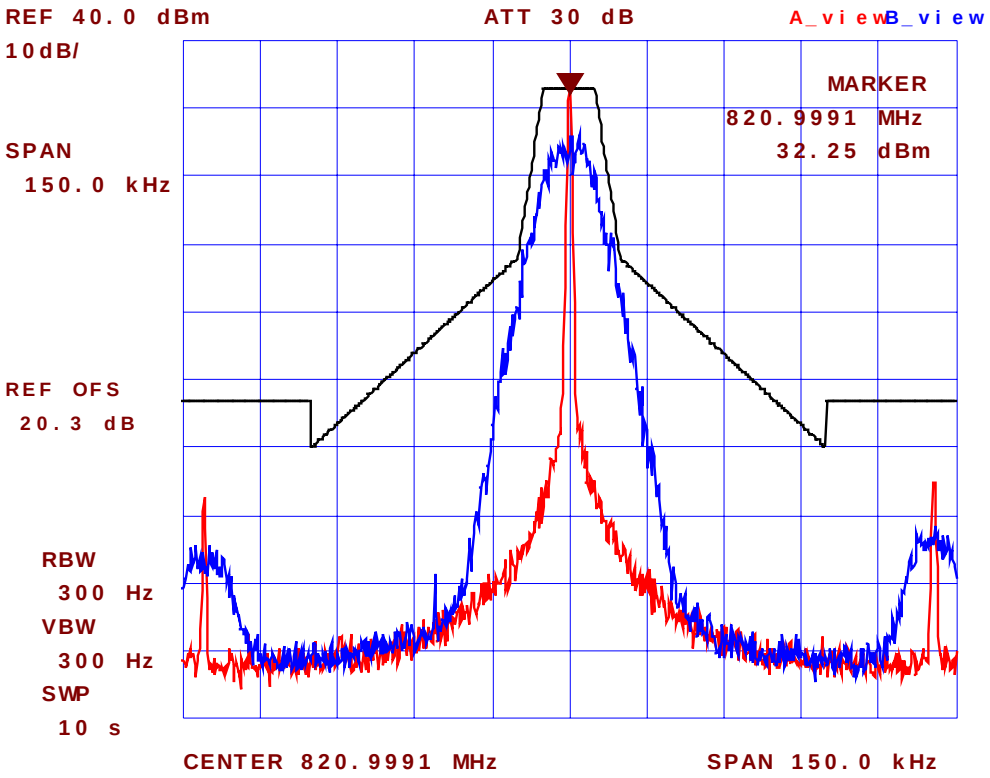
Plot # 6:
Emission Mask G, RF Output, High Power Setting
Test Frequency: 806 MHz, Modulation: 4-Level FSK RDLAP 19.2 kbps



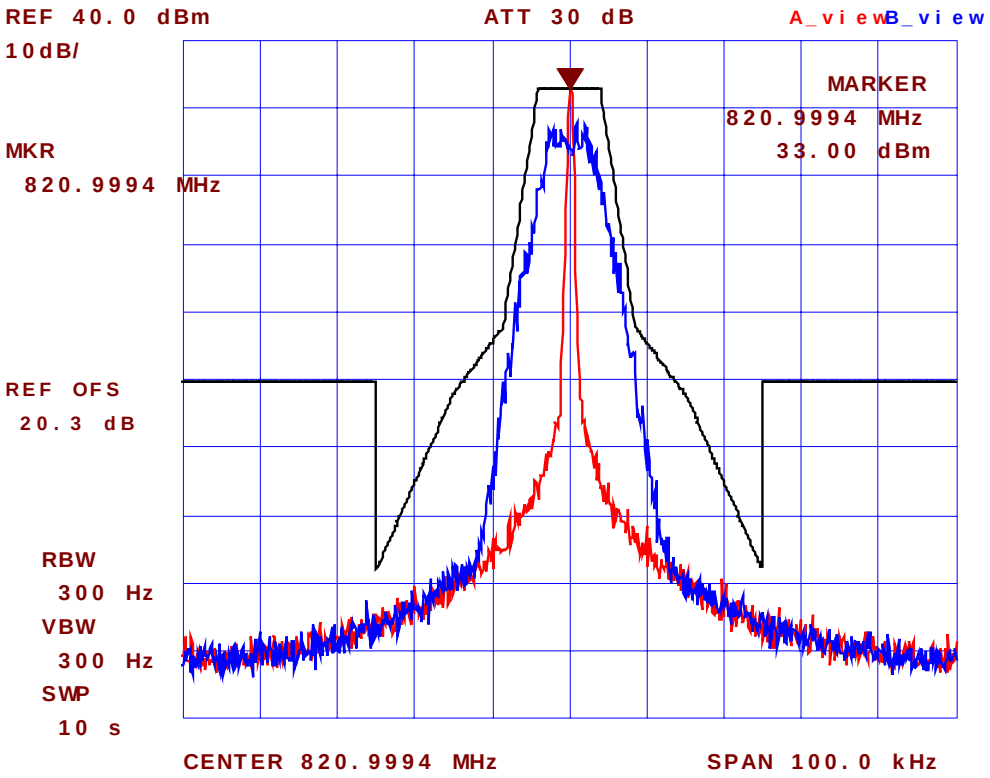
Plot # 7:
Emission Mask G, RF Output, High Power Setting
Test Frequency: 813.5 MHz, Modulation: 4-Level FSK RDLAP 19.2 kbps



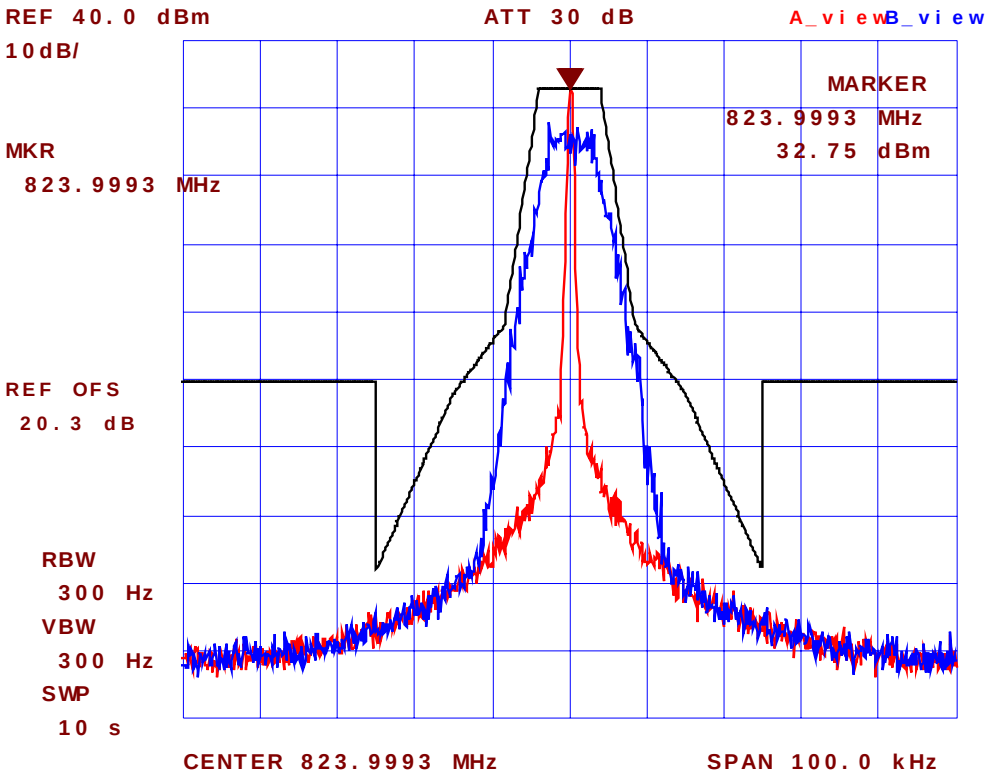
Plot # 8:
Emission Mask G, RF Output, High Power Setting
Test Frequency: 821 MHz, Modulation: 4-Level FSK RDLAP 19.2 kbps



Plot # 9:
Emission Mask H, RF Output, High Power Setting
Test Frequency: 821 MHz, Modulation: 4-Level FSK RDLAP 9.6 kbps



Plot # 10:
Emission Mask H, RF Output, High Power Setting
Test Frequency: 824 MHz, Modulation: 4-Level FSK RDLAP 9.6 kbps



6.7. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 90.210]

6.7.1. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

Frequency Band (MHz)	Frequency Range	Attenuation Limit (dBc)
806-821	30 MHz or Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	Mask G: 43 + 10*log (P in Watts)
821-824	30 MHz or Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	Mask H: 43 + 10*log (P in Watts)

6.7.2. Method of Measurements

The spurious/harmonic ERP measurements are using substitution method specified in Exhibit 8, § 8.2 of this report and its value in dBc is calculated as follows:

(1) If the transmitter's antenna is an integral part of the EUT, the ERP is measured using substitution method.
(2) If the transmitter's antenna is non-integral and diverse, the lowest ERP of the carrier with 0 dBi antenna gain is used for calculation of the spurious/harmonic emissions in dBc:
Lowest ERP of the carrier = EIRP – 2.15 dB = Pc + G - 2.15 dB = Pc dBm (conducted) + 0 dBi – 2.15 dB
(3) Spurious /harmonic emissions levels expressed in dBc (dB below carrier) are as follows:

ERP of spurious/harmonic (dBc) = ERP of carrier (dBm) – ERP of spurious/harmonic emission (dBm)

6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Advantest	R3271	15050203	9kHz – 40GHz
Microwave Amplifier	Hewlett Packard	HP 8449B		1 GHz to 26.5 GHz, 30 dB nominal
Biconilog Antenna	EMCO	3142	10005	30 MHz to 2 GHz
Dipole Antenna	EMCO	3121C	8907-434	30 GHz – 1 GHz
Dipole Antenna	EMCO	3121C	8907-440	30 GHz – 1 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz

6.7.4. TEST DATA

6.7.4.1. High Power Setting at Lowest Frequency (806 MHz) in 806-824 MHz Frequency Band

Fundamental Frequency: 806 MHz
RF Output Power: 33.11 dBm (Conducted)
Modulation: 4 Level FSK with 19.2 kb/s random data
Test Frequency Range: 10 MHz – 10 GHz

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method		Limit (dBc)	Margin (dB)	Pass / Fail
				(dBm)	(dBc)			
4836	80.91	Peak	V	-22.42	-55.5	-46.11	-9.4	Pass
4836	82.97	Peak	H	-20.23	-53.3	-46.11	-7.2	Pass
All spurious emissions and harmonics within 20 dB below the limit were recorded.								

6.7.4.2. High Power Setting at Middle Frequency (815 MHz) in 806-824 MHz Frequency Band

Fundamental Frequency: 815 MHz
RF Output Power: 33.03 dBm (Conducted)
Modulation: 4 Level FSK with 19.2 kb/s random data
Test Frequency Range: 10 MHz – 10 GHz

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method		Limit (dBc)	Margin (dB)	Pass / Fail
				(dBm)	(dBc)			
4890	76.78	Peak	V	-26.04	-59.1	-46.03	-13.0	Pass
4890	79.47	Peak	H	-23.79	-56.8	-46.03	-10.8	Pass
All spurious emissions and harmonics within 20 dB below the limit were recorded.								

6.7.4.3. High Power Setting at Highest Frequency (824 MHz) in 806-824 MHz Frequency Band

Fundamental Frequency:	824 MHz
RF Output Power:	32.97 dBm (Conducted)
Modulation:	4 Level FSK with 9.6 kb/s random data
Test Frequency Range:	10 MHz – 10 GHz

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method		Limit (dBc)	Margin (dB)	Pass / Fail
				(dBm)	(dBc)			
4120	80.28	Peak	V	-22.93	-55.9	-45.97	-9.9	Pass
4120	76.34	Peak	H	-28.05	-61.0	-45.97	-15.1	Pass
4944	81.09	Peak	V	-21.20	-54.2	45.97	-8.2	Pass
4944	77.94	Peak	H	-24.17	-57.1	-45.97	-11.2	Pass
5768	70.88	Peak	V	-32.83	-65.8	-45.97	-19.8	Pass
All spurious emissions and harmonics within 20 dB below the limit were recorded.								

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 8. MEASUREMENT METHODS

8.1. CONDUCTED POWER MEASUREMENTS

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- If the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

- Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with 0<x<1, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

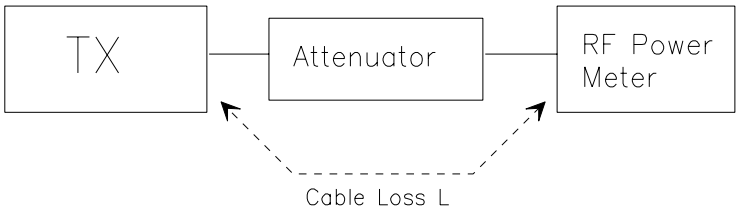
Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

{X = 1 for continuous transmission => 10log(1/x) = 0 dB}

Figure 1.



8.2. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

8.2.1. Maximizing RF Emission Level (E-Field)

(a) The measurements was performed with full rf output power and modulation.
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
(e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level.

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(f) Set the EMI Receiver and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies

8.2.2. Measuring the EIRP of Spurious/Harmonic Emissions Using Substitution Method

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	10 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
- ♦ DIPOLE antenna for frequency from 30-1000 MHz or
- ♦ HORN antenna for frequency above 1 GHz}.

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna:
- ♦ DIPOLE antenna for frequency from 30-1000 MHz or
- ♦ HORN antenna for frequency above 1 GHz}.

(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
ERP = EIRP – 2.15 dB
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

Where:	P:	Actual RF Power fed into the substitution antenna port after corrected.
	P1:	Power output from the signal generator
	P2:	Power measured at attenuator A input
	P3:	Power reading on the Average Power Meter
	EIRP:	EIRP after correction
	ERP:	ERP after correction

(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2:

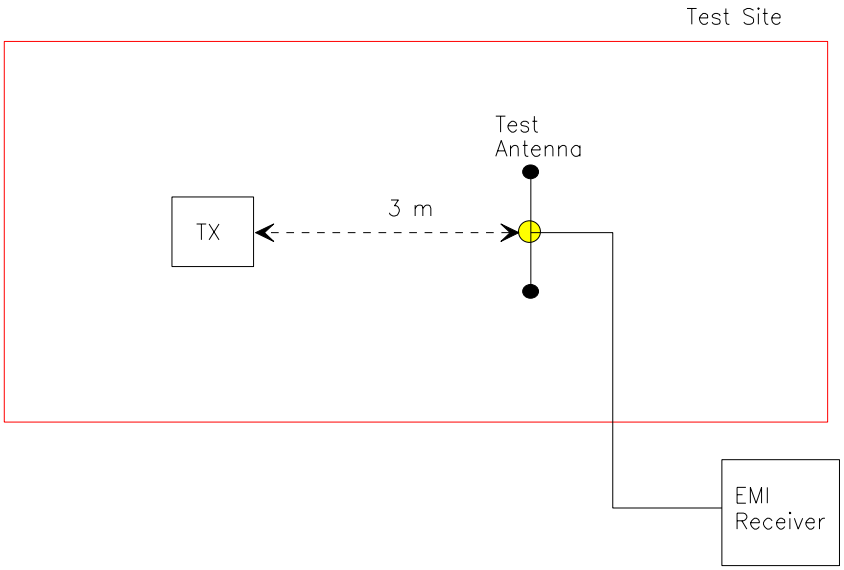
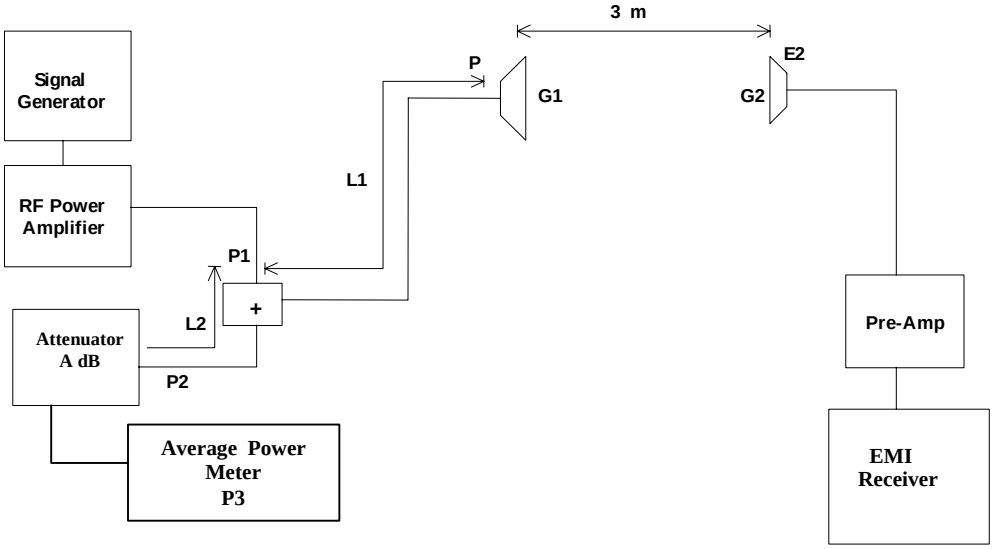


Figure 3:



8.3. EMISSION MASK

Voice or Digital Modulation Through a Voice Input Port @ 2.1049(c)(i):- The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: ±2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

Digital Modulation Through a Data Input Port @ 2.1049(h):- Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the discretion of the user.

The following EMI Receiver bandwidth shall be used for measurement of Emission Mask/Out-of-Band Emission Measurements:

(1) For 25 kHz Channel Spacing: RBW = 300 Hz
(2) For 12.5 kHz or 6.25 kHz Channel Spacings: RBW = 100 Hz

The all cases the Video Bandwidth shall be equal or greater than the measuring bandwidth.