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FCC Parts 22 Test Report

Performed on the

Skyguard GTS Beltpack Tracking System
Model: Skyguard 500/GTS501
For
Continental Divide Robotics
FCC ID: PI8SG501

Date of Test: December 6 to 8, 2000 & January 26 to 27, 2001

Job #: J20030421, J20030424, & J20030428
Report #: 20304211, 20304241, & 20304281

Total No. Of Pages Contained in this Report: 18 + Data Sheets

The results contained in this report were derived from measurements performed on the identified test samples. Any implied performance of other samples on this report is dependent on the representative of the samples tested.

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NVLAP Laboratory Code: 200201-0

FCC Parts 22 Certification, Ver 01/01

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* EUT does not audio Circuits ** Attached as Separate Report

Tested By: Suresh Kondapalli — Date: 02/28/0

Approved By: David Chernomordik — Review Date: 02/28/01
David Chernomordik, Ph.D.,
EMC Site Manager

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1.2 Product Description

The Continental Divide Robotics model Skyguard 500 provides the criminal justice industry with a tracking system that monitors an offender's position minute-by-minute, fromj multiple locations.

For more information, please refer to the attached product description.

Use of Product	Portable transmitter in cellular band
Whether quantity (>1) production is planned	[X] Yes, [ ] No
Cellular Phone standards	CDPD
Type(s) of Emission	40K0F1D
Allowed Deviation	12± 10%
Range of RF Output	28.5 dBm conducted power at antenna terminal 25.2 dBm radiated power (ERP)
Frequency Range	824 - 849 MHz
Antenna(e) & Gain	0 dBi
Detachable antenna ?	[ ]Yes [X] No
Receiver L.O. frequency	
External input	[ ] Audio [x] Digital Data

1.3 Related Submittal(s) Grants

None

2.0 RF Power Output
FCC 2.1046

2. Test Procedure

The transmitter output was connected to a calibrated coaxial attenuator, the other end of which was connected to a spectrum analyzer. Transmitter output was read off the spectrum analyzer in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the spectrum analyzer reading. A power meter was also used to measure the RF power.

Tests were performed at three frequencies (low, middle, and high channels) and on all power levels which can be setup on the transmitters.

2.2 Test Equipment

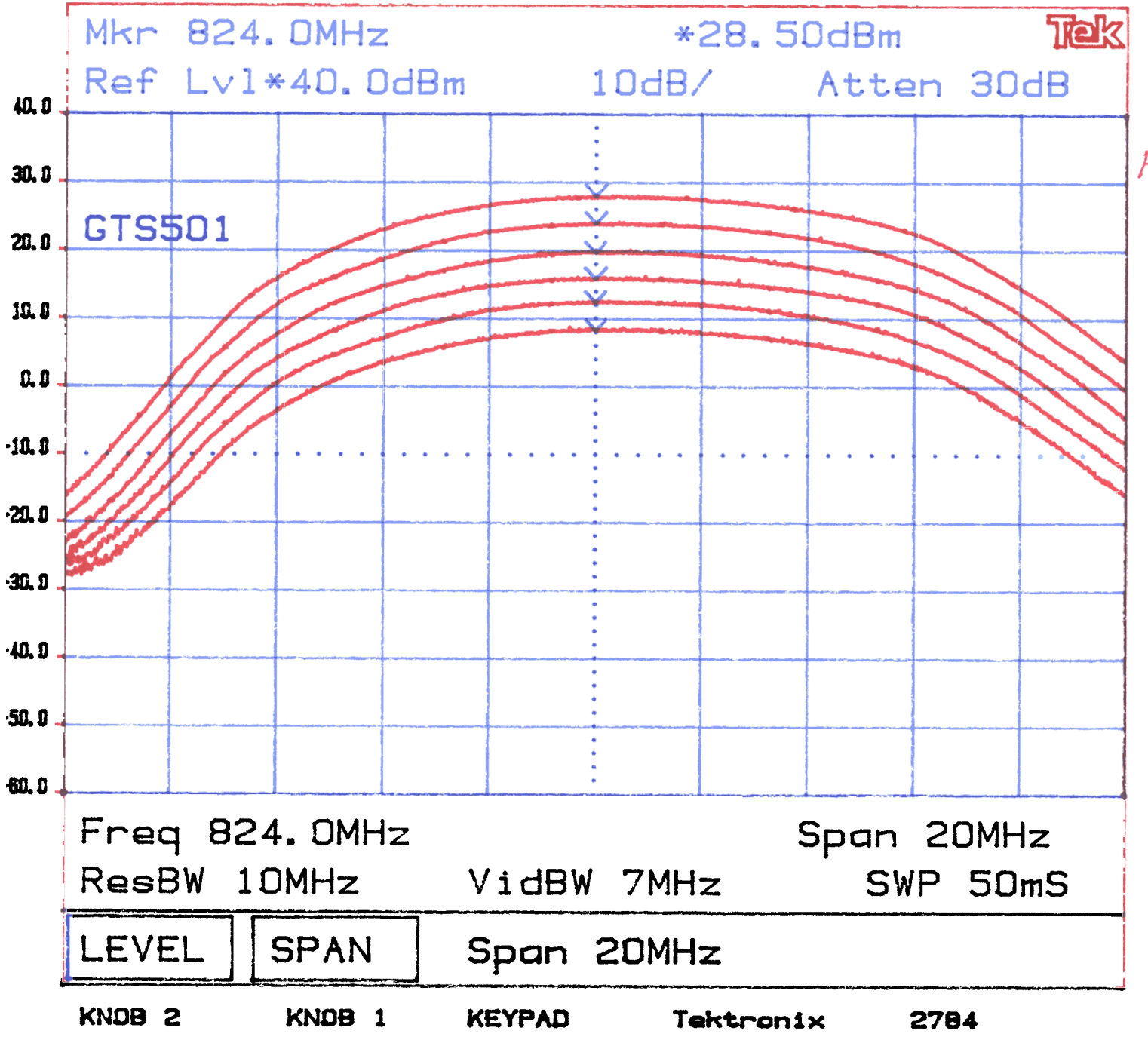
Hewlett Packard 8481A Power Sensor, 435B Power Meter
Hewlett Packard HP8566B Spectrum Analyzer, 100 Hz - 22 GHz
Tektronix 2784 Spectrum Analyzer, 100 Hz – 40 GHz

2.3 Test Results

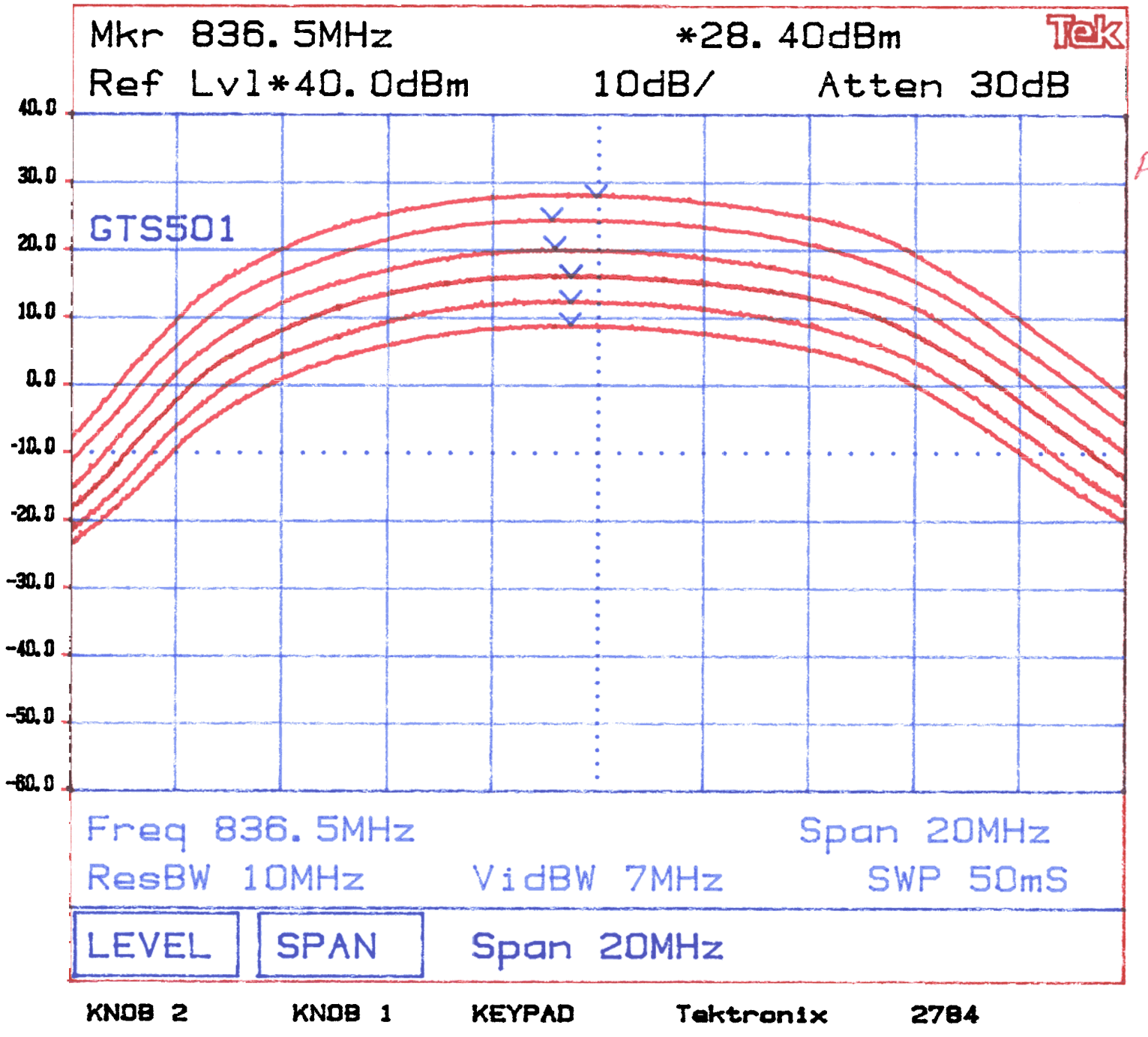
Frequency (MHz)	Measured Power (dBm)
824	28.5
836.5	28.4
849	28.0

For more details refer to the attached plots:

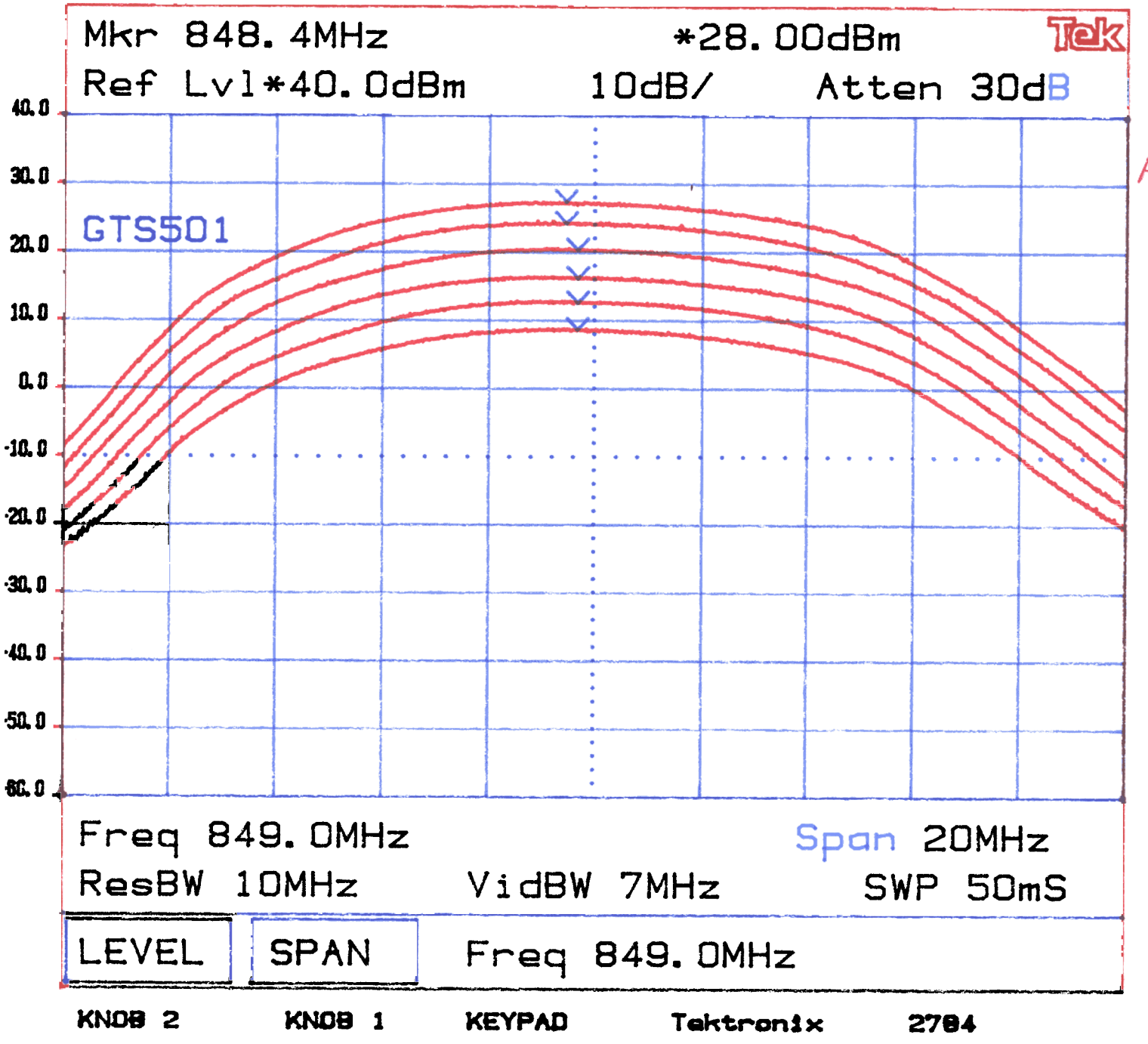
Plot Number	Description
2.3.a	Low Channel
2.3.b	Middle Channel
2.3.c	High Channel


Mkr 824.0MHz
*28.50dBm
Tek
Ref Lvl*40.0dBm
10dB/
Atten 30dB
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
GTS501
Freq 824.0MHz
Span 20MHz
ResBW 10MHz
VidBW 7MHz
SWP 50mS
LEVEL
SPAN
Span 20MHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 2.3a


Mkr 836.5MHz
*28.40dBm
Tek
Ref Lvl*40.0dBm
10dB/
Atten 30dB
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
GTS501
Freq 836.5MHz
Span 20MHz
ResBW 10MHz
VidBW 7MHz
SWP 50mS
LEVEL
SPAN
Span 20MHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 2.3b


Mkr 848.4MHz
*28.00dBm
Tek
Ref Lvl*40.0dBm
10dB/
Atten 30dB
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
GTS501
Freq 849.0MHz
Span 20MHz
ResBW 10MHz
VidBW 7MHz
SWP 50mS
LEVEL
SPAN
Freq 849.0MHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 2.3c

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3.0 Radiated Power

FCC 22.913

The Effective Radiated Power (ERP) of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

3. Test Procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on an open test site. The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. During the measurement, the resolution and video bandwidths of the spectrum analyzer were set to 100 kHz (for frequencies below 1 GHz) and 1 MHz (for frequencies above 1 GHz).

ERP was measured using a substitution method. Worst case radiated emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. The spectrum analyzer reading was recorded. The EUT was replaced by half-wave dipole connected to a signal generator. The spectrum analyzer reading was recorded and ERP was calculated as follows:

$$ERP = R_1 - R_2 + V_g,$$

where R_1 & R_2 are spectrum analyzer readings in dBuV when measured field strength from EUT & generator accordingly; V_g is the generator output in dBm

3.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
EMCO 3148 Log Periodic Antenna
EMCO 3115 Horn Antenna
CDI Robert's Antenna
Rohde & Schwarz SMH 44 signal generator

3.3 Test Results

Passes	Refer to the attached data sheets.

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Field Strength of fundamental

Frequency MHz	Antenna Polarity	Detector	SA Reading dB(μV)	Antenna Factor dB(1/m)	Cable Loss dB	Field Strength dB(μV/m)
825.02	V	Peak	103.2	23.0	2.0	128.2
836.55	V	Peak	103.3	23.3	2.0	128.6
848.97	V	Peak	103.0	23.3	2.0	128.3

Radiated Power (Substitution Method)

Frequency MHz	Antenna Polariz.	Field Strength (EUT) dBμV/m	Field Strength (Sig. Gen. +Tuned Dipole) dBμV/m	Signal Generator Output dBm	ERP dBm
825.02	V	128.2	113.5	10.0	24.7
836.55	V	128.6	113.4	10.0	25.2
848.97	V	128.3	113.3	10.0	25.0

4.0 Modulation Deviation Limiting

FCC 2.1047, 22.915(b)(c)

4.1 Test Procedure

The RF output of the transceiver was connected to the input of an FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings. An audio signal generator with a variable attenuator on the output was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone wires by clip leads.

At three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded (Table 4.1a).

In addition, the audio signal was adjusted to obtain 8 kHz deviation at 1 kHz modulation frequency. Then the input signal was increased in 1 step by 20 dB and the peak deviation and steady state deviation were recorded. This test was performed at modulation frequencies from 300 Hz to 3 kHz.

4.2 Test Equipment

Marconi 2955A Radio Communication Test Set
Leader LFG-1300S Function Generator
LMV-182 AC Millivoltmeter

4.3 Test Results

Test is not applicable. The EUT does not have audio input.

5.0 Audio Filter Characteristics
FCC 22.915(d)

For mobile stations, these signals must be attenuated, relative to the level at 1 kHz, as follows:

(i) In the frequency ranges of 3.0 to 5.9 kHz and 6.1 to 15.0 kHz, signals must be attenuated by at least 40 log (f/3) dB, where f is the frequency of the signal in kHz.

(ii) In the frequency range of 5.9 to 6. kHz, signals must be attenuated at least 35 dB.

(iii) In the frequency range above 15 kHz, signals must be attenuated at least 28 dB.

5. Test Procedure

The RF output of the transceiver was connected to the input of an FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings. An audio signal generator with a variable attenuator on the output was coupledl into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone wires by clip leads.

The audio signal at the transceiver audio input was adjusted to obtain 8-9 kHz deviation at the more sensitive modulation frequency. The audio frequency was varied from 300 Hz to 30 kHz and the deviation was measured while maintaining a constant input level. Using the level measured at 1 kHz as a reference (0 dB), the audio filter response was calculated.

5.2 Test Equipment

Marconi Instruments 2955A Radio Communications Test Set
HP 3588A Spectrum Analyzer
HP 7470A Plotter
Leader LFG-1300S Function Generator
LMV-182 AC Millivoltmeter

5.3 Test Results

Test is not applicable. The EUT does not have audio input.

6.0 Emission Limitations, Occupied Bandwidth
FCC 2.1049, 22.917(b)(d)

For F3E/F3D emission mask uses with audio filter, the mean power of emissions must be attenuated below the mean power of the unmodulated carrier wave (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but not more than 45 kHz: at least 26 dB;

(2) On any frequency removed from the carrier frequency by more than 45 kHz, up to the first multiple of the carrier frequency: at least 60 dB or 43 + 10 log P dB, whichever is the lesser attenuation.

For F1D emission mask, the mean power of emissions must be attenuated below the mean power of the unmodualted carrier (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but no more than 45 kHz: at least 26 dB;

(2) On any frequency removed from the carrier frequency by more than 45 kHz but not more than 90 kHz: at least 45 dB;

(2) On any frequency removed from the carrier frequency by more than 90 kHz, up to the first multiple ofthe carrier frequency: at least 60 dB or 43 +10 log P db, whichever is the lesser attenuation.

6. Test Procedure

The RF output of the transceiver was connected to the input of the spectrum analyzer through sufficient attenuation. The modulation of the transmitter was turned OFF and the spectrum with no modulation was recorded.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz. The modulation was turned ON and the spectrum was recorded in the frequency band ±50 kHz and ±100 kHz from the carrier frequency.

6.2 Test Equipment

HP 8566B Spectrum Analyzer
Marconi 2955A Radio Communication Test Set
HP 7470A Plotter

6.3 Test Results

Passed	Refer to the attached plots.

Plot Number	Description
6.3.a	Carrier frequency, no modulation, scan 100 kHz

6.3.b	Wideband emissions (0, 1, 0, 1), scan 100 kHz
6.3.c	Wideband emissions (0, 1, 0, 1), scan 200 kHz