Network Systems Organization

Norman H. Nelson
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Federal Communications Commission
Equipment Approval Services
P.O. Box 358315
Pittsburgh, PA 15251-5315

Re: FCC ID H9PLA3021-500 Ref # 15514

Date: 10/12/00

Dear Reviewer,

In response to the following Email:

To: Norman Nelson, Symbol Technologies, Inc.
From: Joe Dichoso
jdichoso@fcc.gov
FCC Application Processing Branch

Re: FCC ID H9PLA3021-500
Applicant: Symbol Technologies Inc
Correspondence Reference Number: 15514
731 Confirmation Number: EA98018
Date of Original E-Mail: 08/10/2000

Place your reply in the RF exposure info folder. Keep separate from any previous request for information.

Symbol, EA 98014 (Class II) -

1. The EMC report is indicating 5 antennas and the cover letter indicates this Class II Permissive Change filing is adding 9 antennas. The MPE info is indicating 7 of the 9 antennas have multiple connector configurations (a total of 16 configurations). Please clarify how many antenna configurations are applicable for this filing.

   Per prior correspondence with the FCC it was determined that only the antenna with the highest gain for each type needed to be tested. The TR Status (Test Report Status) column for each antenna either refers you to the test report for its data (tested) or to the higher gain antenna of the same type for its test data.

   The LA3021-500 uses a MMCX connector. Only the configurations using the MMCX connector are under consideration.

   Please note that I have added two additional antennas to this application. The test data for these two are uploaded to the FCC web site and Antenna # 10 MPE and Antenna #11 MPE are attached to this document. I also include

updated RF Exposure Summary Table for this application and Antenna History List for this FCC ID. This makes for a total of 11 antennas for this application. In addition I have attached a configuration table that spells out each of the 11 antenna / terminal configurations for this application.

2. The antenna list indicates the Rubber Duck antenna is for vehicle-mount use. MPE info indicates this antenna is for incorporation into hand-held devices. Please clarify the antenna configuration and state the actual devices that will be operating with this antenna configuration.

The location in the MPE info is incorrect. The photos are correct showing this antenna with a RP-BNC connector on an Access Point at a fixed location while the RP-TNC version is on the vehicle-mounted terminal. The rubber duck with the RP-BNC is currently certified under this FCC ID in a mobile device configuration. We want to add the vehicle mount configuration for the RP-TNC connector version. I have included a corrected version of the Antenna #1 MPE info.

3. Specs for the Toko antenna has 2.15 dBi peak gain, which should be used for MPE estimations instead of the 0 dBi typical gain indicated on the antenna list.

The 2.15 dBi figure in the data sheet is with the shown generous ground plane. For the hand held device with a sub-generous ground plane 0 dBi is the max with –4 dBi being typical. See the attached antenna plot.

4. The RF exposure statement for the "Vocollect" antenna needs revision. This antenna is only applicable to the specific belt-worn configuration and output power described for this filing. Users should be instructed to use this antenna and belt-worn configuration in specific manners (as described in the manual and this filing) for satisfying FCC RF exposure compliance. Please revise and upload relevant page(s) of the manual for this antenna configuration.

Attached is an updated antenna #4 MPE information that includes the language added to the user information.

5. There is a 68% duty factor applied to the Vocollect body-worn configurations. Please verify if this duty factor had been included in the original filing and explain why would different duty factors be applied to mobile and portable devices. Only source-based time-averaging factors may be used, please provide the applicable information to qualify for source-based time averaging.

Please see the uploaded proprietary Duty Cycle exhibit.

Note: Output is 250 mW.

The output power in watts on the Form 731 is incorrectly listed at 250 mW. The correct value is 331 mW as listed on the original grant dated 3/14/2000. The same card as used with the original grant with 331 mW of output power was used for testing. I have emailed Bette Taube to correct the 731.

I hope these answers are satisfactory.

Respectfully,

Norman H. Nelson
Sr. EMC Engineer

RF Exposure Antenna Summary

Network Systems Organization

FCC ID: **H9PLA3021-500** WLAN PC Card, 2 Mbps, Proj. C, Hi Pwr

Output Power: 331 mW Class II Permissive Change

Source Based

Mobile DC Factor: 0.650

Portable DC Factor: 0.640

Mobile Antennas (R>20cm)

Ant No	Model	Symbol P/N	Type	Gain (dBi)	Cabel Loss (dB)	Pout (dBm)	MPE (cm)	TR Status	Device Type
01.	Rubber DuckTNC-RP	50-21900-029	Dipole	1.0	0.00	25.20	3.7	Tested	Vehicle Mount
02.	XP	50-21900-024	Slot	0.0	0.58	24.62	3.1	Tested	Hand Held Ocp
03.	Toko	50-21900-022	Puck	0.0	0.00	25.20	3.3	Tested	Hand Held Ocp
05.	1742	703549-2	F-Element	0.0	0.11	25.08	3.3	Tested	Hand Held Ocp
06.	2742	703624-2	F-Element	0.0	0.13	25.07	3.3	See # 5	Hand Held Ocp
07.	7242	10-35477-01	F-Element	0.0	0.12	25.07	3.3	See # 5	Hand Held Ocp
08.	6846	10-32290-02	F-Element	0.0	0.34	24.86	3.2	See # 5	Hand Held Ocp
09.	7546	10-38649-02	F-Element	0.0	0.31	24.89	3.2	See # 5	Hand Held Ocp
10.	IEC PC-HP	LA-3021-500	Patch	2.0	0.00	25.20	4.2	Tested	Laptop
11.	6146	10-35305-02	F-Element	0.0	0.12	25.08	3.3	Tested	Hand Held Ocp

Portable Antennas (R < 5cm)

Ant No	Model	Symbol P/N	Type	Gain (dBi)	Cabel Loss (dB)	Pout (dBm)	EIRP (mW)	TR Status	Device Type	Tx Limited
04.	Vocollect MMCX	50-21900-025	Dipole	2.0	0.25	24.95	317.1	Tested + SAR	Belt Worn 5-	

Antenna Gain listed without cable
TR Status refers to weither the antena was tested. If not refer to the directed antenna test data

Duty Cycle Factors are applied to MPE and EIRP

Tx Limited configurations are for low power versions of the radio. See the specific antenna exhibit for detail

Antenna List by FCC ID

Network Systems Organization

FCC ID: **H9PLA3021-500** WLAN PC Card, 2 Mbps, Proj. C, Hi Pwr

Output Power: 331 mW

Grant Date	Ant #:	Model	Symbol P/N	Mfg	Mfg P/N
3/14/00					
	01	Plane	50-21900-008	Tecom	505042C(48IN)
	02.A	Pipe Bomb 11"x4'	50-11901-048P	Cushcraft	S2403BHPS48RBN
	02.B	Pipe Bomb 11"x15'	50-11901-180P	Cushcraft	S2403BHPS180RB
	03	Rubber Duck	50-21900-007	Cushcraft	RBN2400SXR
	04	Yagi	ML-2499-YGA1-	Cushcraft	PC2415RBN240
	05	Patch	ML-2499-PTA1-	UK	S2406P72PRBN
	06	Panel	ML-2499-PNA1-	Tecom	ML-2499-PNA1-01
	07	End Cap "C"	10-20511-01	Tecom	822319
	08	4140	50-11900-001	Dorne & Margol	DR10-2
	09	4640	21-17486-01	AIL Systems Suf	21-17486-01
	10	2040	10-17577-01	Tecom	703117
	11	6140	10-35305-01	UK	
	12	6840	10-32290-01	UK	
	13	1040	10-32447-01	Tecom	703385-1
	14	HS Dipole	50-21900-030	Huber Suhner	9090.16.0001
	15	Parapolic Grid	ML-2499-PGA1-	Conifer	26T-2400
	16	Pipe Bomb 25"x20'	50-11902-240S	Cushcraft	S2406BHS240RBN
	17	Criticare BFA	50-21900-021	Tecom	703443-1
	18	Corner Patch	ML-2499-DLA1-	Tecom	505126C
	19	Ceiling Panel	50-21900-015	Cushcraft	SQ2403PS72RBN
	20	6140 OBS	10-17577-02	Tecom	
	21	Mag Dipole	ML-2499-MGA1	Centurian	CAF95770
Applied For					
	01	Rubber DuckTNC-	50-21900-029	Cushcraft	RTN2400SXR
	02	XP	50-21900-024	Tecom	703611
	03	Toko	50-21900-022	Toko	DAC2450CT1
	04	Vocollect MMCX	50-21900-025	Austin Antenna	200215
	05	1742	703549-2	Tecom	703549-2

FCC ID: **H9PLA3021-500** WLAN PC Card, 2 Mbps, Proj. C, Hi Pwr

Output Power: 331 mW

Grant Date	Ant #:	Model	Symbol P/N	Mfg	Mfg P/N
	06	2742	703624-2	Tecom	703624-2
	07	7242	10-35477-01	Tecom	
	08	6846	10-32290-02	Tecom	
	09	7546	10-38649-02	Tecom	
	10	IEC PC-HP	LA-3021-500	Symbol	60-20926-01
	11	6146	10-35305-02	Tecom	10-35305-02

RF Exposure Configuration Summary

Network Systems Organization

FCC ID: **H9PLA3021-500** WLAN PC Card, 2 Mbps, Proj. C, Hi Pwr

Output Power: 331 mW Class II Permissive Change

Ant #	Antenna Model	Terminal Mfgr.	Terminal Model	Use
01	Rubber Duck	LXE	1380	Vehicle Mount
02	XP	Mitsubishi	XPn	Hand Held Ocp
03	Toko	Percon	Falcon315	Hand Held Ocp
04	Vocollect M	Vocollect	Talkman Open	Belt Worn 5-
05	1742	Symbol	SPT-1742	Hand Held Ocp
06	2742	Symbol	SPT-2742-500	Hand Held Ocp
07	7242	Symbol	PDT-7242	Hand Held Ocp
08	6846	Symbol	PDT-6842	Hand Held Ocp
09	7546	Symbol	PDT-7542	Hand Held Ocp
10	IEC PC-HP	Generic	Laptop	Laptop
11	6146	Symbol	PDT-6142	Hand Held Ocp

5- R < 5 cm
5+ 5 cm < R < 20 cm
Ocp Ocupational

Rubber Duck Antenna

Location	Wall / Vehicle Mount
Pattern	Omni
Type	Dipole
Max Gain	1 dBi
Physical	See attached dwg
Cable	none
Symbol P/N	ML-2499-APA1-00 ML-2499-APA2-00

The **Rubber Duck** antenna is 1 dBi omni-directional in azimuth plane. It is mounted either on the rear end of the fixed mouted terminal or on the top end of the vehicle mounted terminal as shown in the attached photos. The fixed terminal is mostly wall mounted but could be on a flat surface more than 20 cm from any user. The fixed mounted terminal uses a BNC-RP connector while the vehicle mounted terminal uses the TNC-RP. In its use on the vehicle mounted terminal it could be within 20 cm of a persons hand but more than 20 cm from the users body. It is used in mobile devices. The RF exposure information is included in a prominent place in the device's user manual and is listed next to the configuration photographs.

Antenna Photograph

Vehicle mounted device Photo

"CAUTION: Exposure to Radio Frequency radiation. To conform to FCC RF exposure requirements this antenna shall be installed in such a manner that it may be located near hands but must be more than 20 cm from any persons body during normal operating conditions."

RF Safety information

Fixed mounted device Photo

"CAUTION: Exposure to Radio Frequency radiation. To conform to FCC RF exposure requirements this antenna shall be installed to ensure a minimum separation distance of 20 cm from all persons during normal operating conditions."

RF Safety information

REVISIONS			
REV	DESCRIPTION	DATE	APPVL
A	DOCUMENT RELEASED PER EDR# 19075	7/26/96	M.W.
B	REMOVE CONFLICTING DIMENSION PER EC E3485	1/11/98	

General Notes:

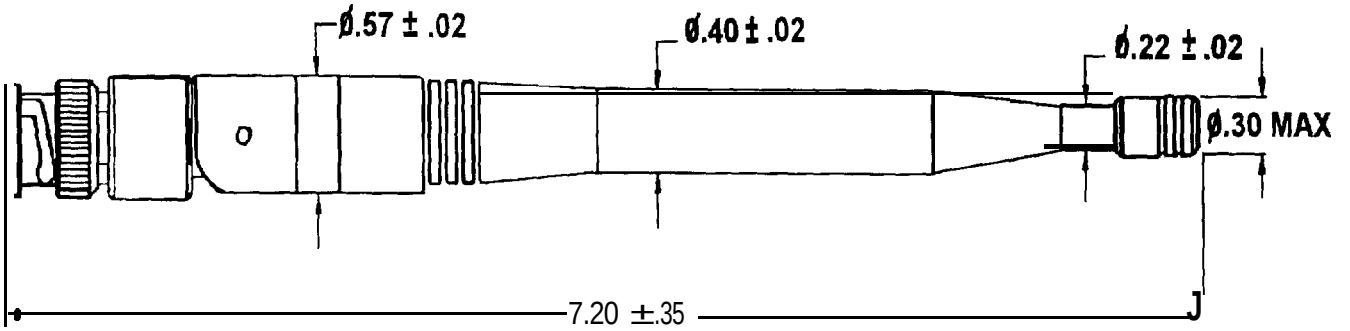
THE FOLLOWING STI SPECIFICATIONS APPLY:

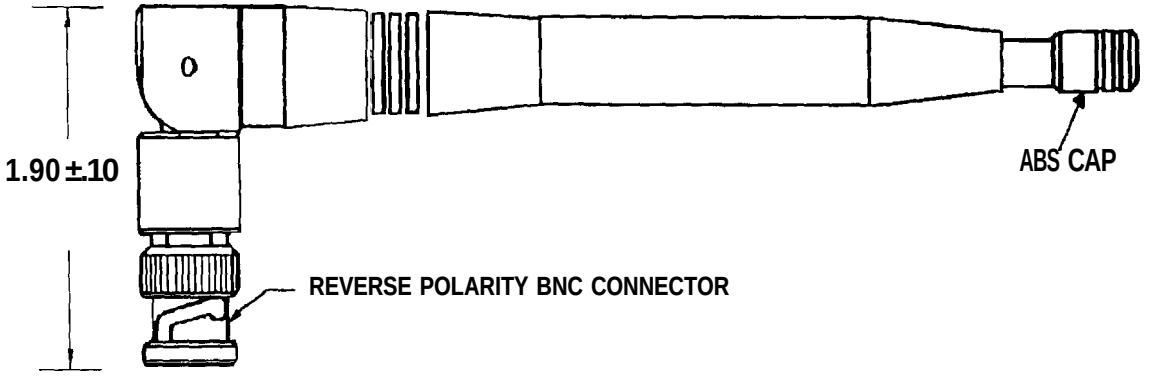
50-04100-013: **Specification For Supplier Packaging And Labeling Requirements**

EN-I 0983-01 **General Component Requirements**

RELEASED

APPROVAL	NAME	DATE	COMPONENT SPECIFICATION
DRAWN	D.FORTIER	7/ 1/96	
CHECKED	M.WELLS	7/26/96	**ANTENNA:RADIO,FLEX, 2.4-2.5GHz**
ENG	M. POPE		***REVERSE POLARITY BNC,50 OHM, ARTICULATE JOINT**
CEG	T.SMURA	7/30/96	DOCUMENT No. 50-21900-007 REV B
			SHEET 1 of 2





DRAWING NOT TO SCALE

Bandwidth:	2.4 to 2.5 Ghz
VSWR:	1.5:1 Max. at resonance
Gain:	1.0 dBi
Power Rating:	50 Watts
Torque Test:	20 in-lbs.
Operating Temperature:	-40° - +85°C
Flex Test:	Per QEA0014
Pull Test:	20lbs Liner Pull

Dimensions are in inches unless otherwise noted
Tolerances are as follows .XX= ±.010 unless otherwise noted.

Vocollect Antenna

The **Vocollect** antenna is 2 dBi omni-directional in azimuth plane. It is mounted internally as shown in the attached photo. The **Vocollect** uses either a Murata Erie BFA or a MMCX connector. In its use it would be within 5 cm of a persons body. It is used in portable devices. This antenna / device combination was SAR tested and results filed with a Class II permissive change for the H9PLA3020. The antenna was driven by 240 mW of transmitter power. This produces an EIRP limit of 380 mW. Below is the user safety information located in the users manual.

Location	Body worn device
Pattern	Omni
Type	Dipole
Max Gain	2 dBi
Physical	See attached dwg
Cable	MXYH75, RG-178
Symbol P/N	50-21900-025, 50-21900-026

"Warning: Exposure to Radio Frequency radiation. To conform to FCC RF exposure requirements this device shall be used in accordance with the operating conditions and instructions listed in this manual."

Antenna Photo

Talkman Open – 2.4 GHz Symbol Radio Information

Vocollect Antenna Specifications

Type:	Dipole
Gain:	2 dBi
Polarization:	Circular
Physical description:	Implemented on flat and rigid printed circuit board, internally mounted, parallel to the belt mounting loop.
Min distance from skin:	2.1 inches (1.70 inches to inside to belt loop plus 0.40 inches of padded belt)

Table 1: Bill of Materials- Talkman Open – Symbol Radio and Antenna

Item	Qty	Vocollect Part #	Vendor Part #	Supplier	Description
1	1	656022		Austin Antenna	ANTENNA PCB
2	1	606012	90174601	Huber-Suhner	CABLE ASSY, ANTENNA

Vocollect, Inc. • 701 Rodi Road • Pittsburgh, PA • 15235 • 412-829-8145 • 412-829-0972

Image 1: 2.4 GHz Antenna PC Board

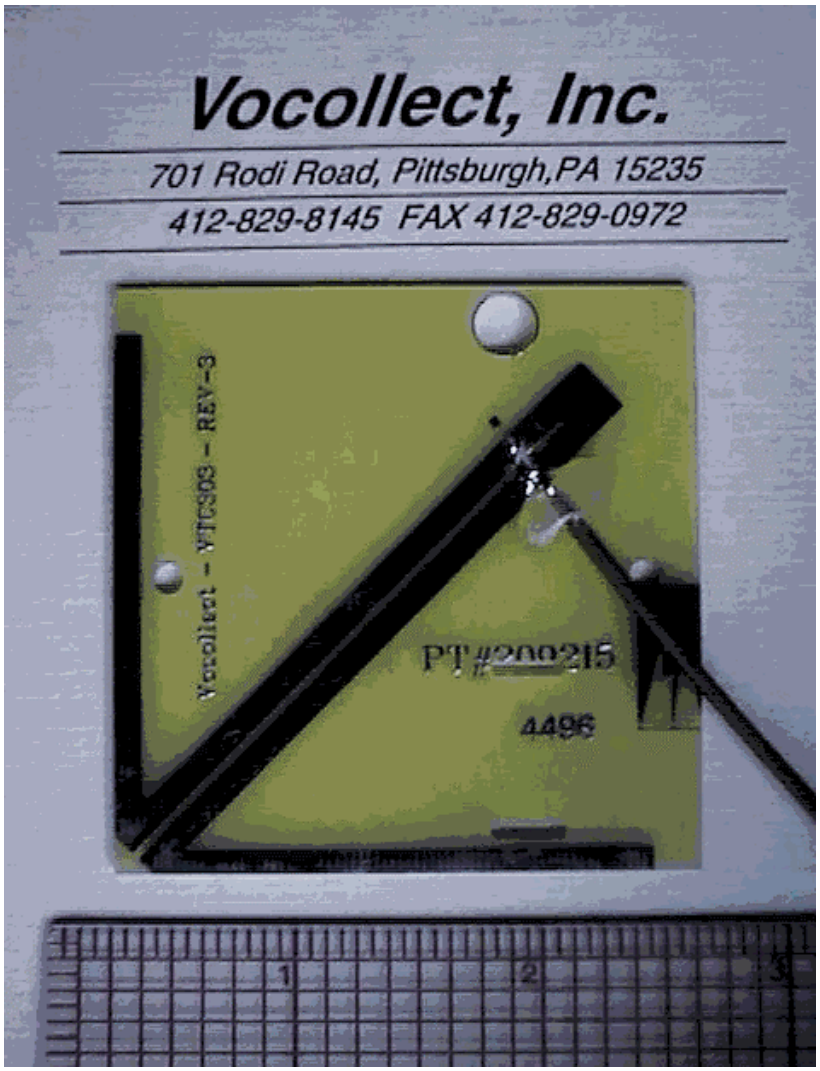


IMAGE 2: Beltworn Terminal - Drawing

IMAGE 3: Beltworn Terminal

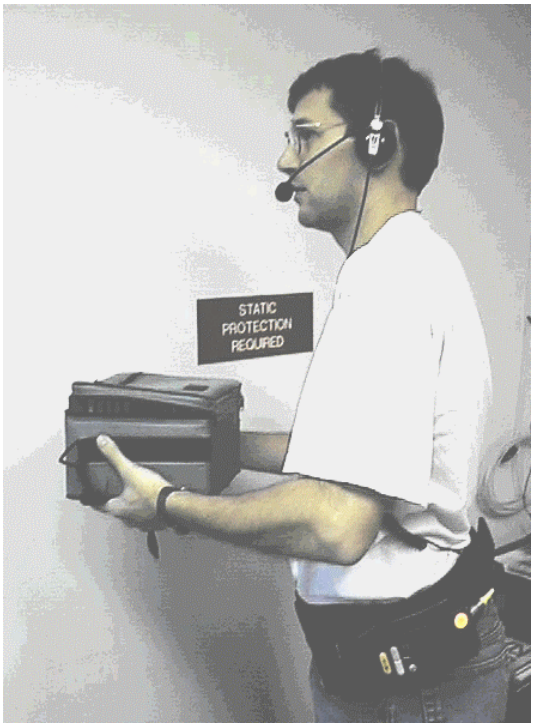


IMAGE 4: Drawing of Antenna Placement Inside Unit.

The antenna is mounted in the plane parallel to the belt loop and waist, 1.70 inches away from the belt loop used to connect the terminal to the padded mounting belt. Including the belt thickness, the radio is at least 2.1 inches distant from the skin.

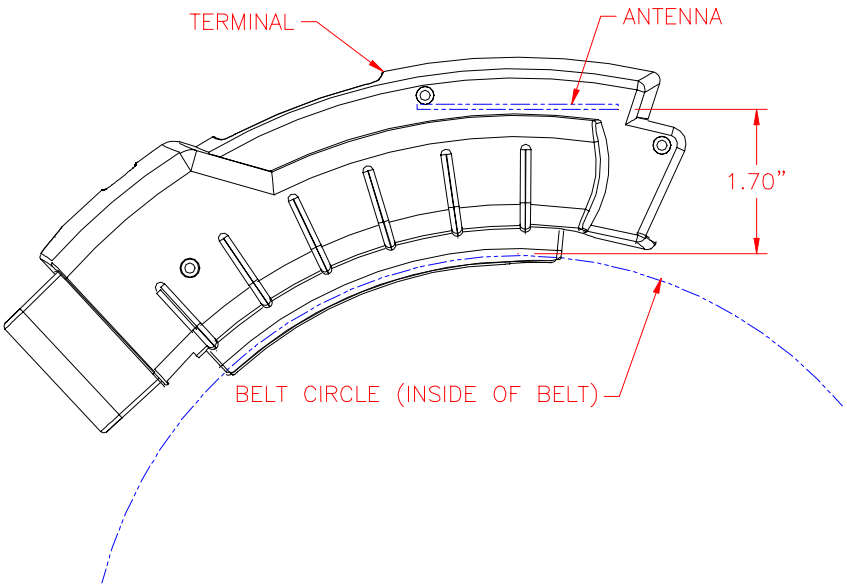


IMAGE 5: The unit mounts on a padded belt ½" thick.

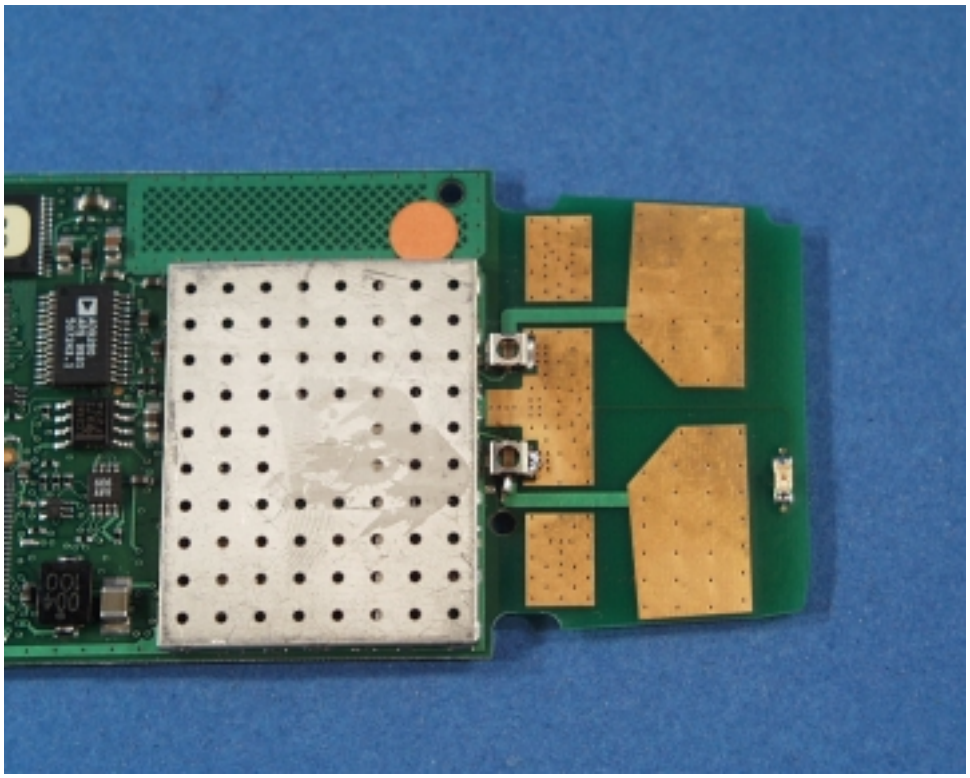
The unit is connected to the belt be a secondary strap secured to the belt. The full width of the main padded belt remains between the terminal and user's body.

IEC PC Antenna

The **IEC PC** antenna is 0 dBi omni-directional in azimuth plane. It is printed on a extended version of the PCB as shown in the attached photo. There are two patches for spatial diversity. The **IEC PC** does not use a connector. In its use it could be within 20 cm of a persons hand but more than 20 cm from the users body. It is used in portable devices. The following RF exposure information is included in a prominent place in the device's user manual to inform the user of safety issues as required by OET Bulletin 65, Supplement C for EIRP greater than 200 mW.

Location	Laptop PC
Pattern	Omni
Type	Patch
Gain	0 dBi
Physical	See attached dwg
Cable	none
Symbol P/N	24- 20776- 02
EIRP	See Summary Tbl

"CAUTION: Exposure to Radio Frequency radiation. To conform to FCC RF exposure requirements this antenna shall be installed in such a manner that it may be located near hands but must be more than 20 cm from any persons body during normal operating conditions."



Antenna Internal Photo

Antenna External Photo

Antenna Use Photo

6140 / 6146 Antenna

Location	Hand Held Device
Pattern	Omni
Type	F-Element
Max Gain	0 dBi
Physical	See attached dwg
Cable	MXYH75, RG-178
Symbol P/N	10-35305-01, -02

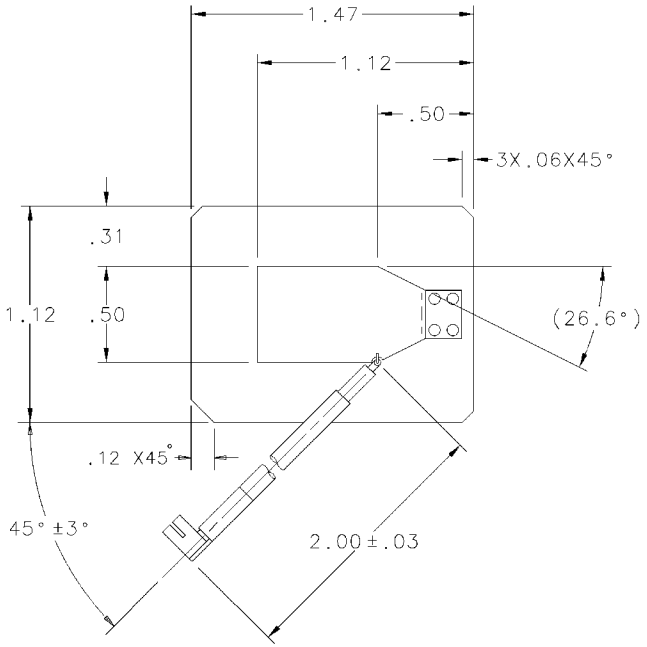
The 6146 antenna is 0 dBi omni-directional in azimuth plane. It is mounted internally on the top end of the terminal as shown in the attached photo. The 6140 uses the Muratta Erie BFA connector. The 6146 uses the MMCX connector. In its use it would be within 20 cm of a persons hand but more than 20 cm from the users body. It is used in portable devices. The following RF exposure information is included in a prominent place in the device's user manual to inform the user of safety issues as required by OET Bulletin 65, Supplement C for EIRP greater than 200 mW.

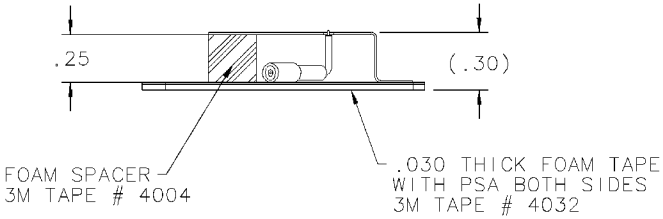
"CAUTION: Exposure to Radio Frequency radiation. To conform to FCC RF exposure requirements this hand held device is only approved for use in the user's hand when there is 20 cm or more between the antenna and any persons body during normal operating conditions."

Antenna Installed in Device

Terminal Use Photo

REVISIONS							
REV.	ZONE	No.	DESCRIPTION	E.C.	BY	APVD.	DATE
A			RELEASED PER EDR #40629		LM		6-26-98
B			REVISED PER EC #E5139		MB		9/15/98
C			REVISED PER EC #E5338		JKW		10/5/98





SPECIFICATIONS

FREQUENCY:	2400-2485 MHz
VSWR:	2:1
GAIN:	0dbi NOMINAL
CABLE/ CONNECTOR	TECOM 817283-19 MXYH62XXXXXXXX

NOTES: UNLESS OTHERWISE SPECIFIED:

1. MATERIAL: CRS 1008, .010±.001 THICK.
2. FINISH: BRIGHT TIN PLATE PER MIL-T 10727A, TYPE 1 ELECTRO DEPOSITED .00010-.00025 INCHES. FINISH SHALL BE UNIFORM AND EXHIBIT NO EVIDENCE OF COROSION OR OXIDATION WHEN VIEWED WITH THE UNAIDED EYE. EDGE PLATING ON CUT OR SHEARED SURFACES IS NOT REQUIRED.
3. BREAK AND DEBUR ALL SHARP CORNERS AND EDGES .005 MAX PRIOR TO PLATING.
4. OPERATING TEMPERATURE: -20 TO +50°C. STORAGE TEMPERATURE: -40 TO +70°C. HUMIDITY: 95% NON CONDENSING
5. PACKAGE ITEMS IN ACCORDANCE WITH STI GENERAL PACKAGING SPEC #50-04100-013.

ITEM	QTY.	PART NO.	DESCRIPTION	REMARKS/REF. SYMBOL

DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED

	MM	INCH
.XX	+/-	+/- .01
.XXX	+/-	+/- .005

ANGLES ± 1° FRACTIONS ± 1/64

MATERIAL: SEE NOTE

FINISH: SEE NOTE

APPROVALS	DATE
DRAWN LJM	1/22/98
CHECKED F GONG	
ENGINEER F GONG	
MFG. ENG. F MAZURKIEWICZ	
PRODUCT T HOFBAUER	
QUALITY	

SYMBOL TECHNOLOGIES INC.
Bohemia, New York

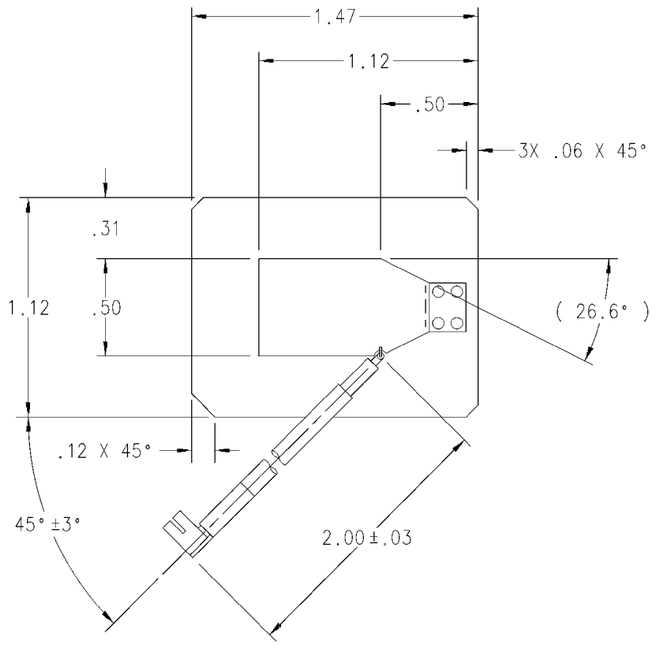
ANTENNA: TYPE F,S24, COBALT

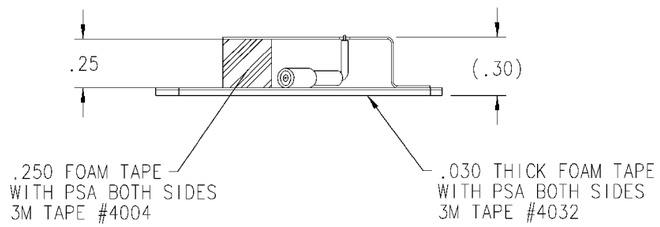
SIZE C | DWG. NO. 10-35305-01 | REV. C

SCALE: 2/1 | SOLID MODEL YES / NO X | SHEET 1 OF 1

NEXT ASSY	USED ON	DO NOT SCALE DRAWING

REVISIONS							
REV.	ZONE	No.	DESCRIPTION	E.C.	BY	APVD.	DATE
A			RELEASED PER EDR #53453		JS		1/13/00





NOTES: UNLESS OTHERWISE SPECIFIED.

1. MATERIAL: CRS 1008, .010±.001 THICK.
2. FINISH: BRIGHT TIN PLATE PER MIL-T 10727A, TYPE 1 ELECTRO DEPOSITED .00010-.00025 INCHES. FINISH SHALL BE UNIFORM AND EXHIBIT NO EVIDENCE OF CORROSION OR OXIDATION WHEN VIEWED WITH THE UNAIDED EYE. EDGE PLATING ON CUT OR SHEARED SURFACES IS NOT REQUIRED.
3. BREAK AND DEBUR ALL SHARP CORNERS AND EDGES .005 MAX PRIOR TO PLATING.
4. OPERATING TEMPERATURE: -20 TO +50°C.
   STORAGE TEMPERATURE: -40 TO +70°C.
   HUMIDITY: 95% NON CONDENSING.
5. PACKAGE ITEMS IN ACCORDANCE WITH STI GENERAL PACKAGING SPEC #50-04100-013.

SPECIFICATIONS:

FREQUENCY:	2400-2485 MHz
VSWR;	2:1
GAIN:	0dbi NOMINAL
CABLE:	RG178
CONNECTOR:	50-22100-029

ITEM	QTY.	PART NO.	DESCRIPTION	REMARKS/REF. SYMBOL

	PDT6140
NEXT ASSY	USED ON

DO NOT SCALE DRAWING

DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED

	MM	INCH
.XX	+/-	+/- .01
.XXX	+/-	+/- .005

ANGLES ± 1° FRACTIONS ± 1/64

MATERIAL: SEE NOTE 1

FINISH: SEE NOTE 2

APPROVALS	DATE
DRAWN J.SIMMONS	1/13/00
CHECKED M.SAVONA	1/13/00
ENG. B.ROSENGRANT	1/13/00
MFG. ENG.	
PRODUCT	
QUALITY	

SYMBOL TECHNOLOGIES INC.
Bohemia, New York

ANTENNA: TYPE F,S24, COBALT, MMCX

SIZE	DWG. NO.	REV.
C	10-35305-02	A

SCALE: 2:1 | SOLID MODEL | YES | NO X | SHEET 1 OF 1

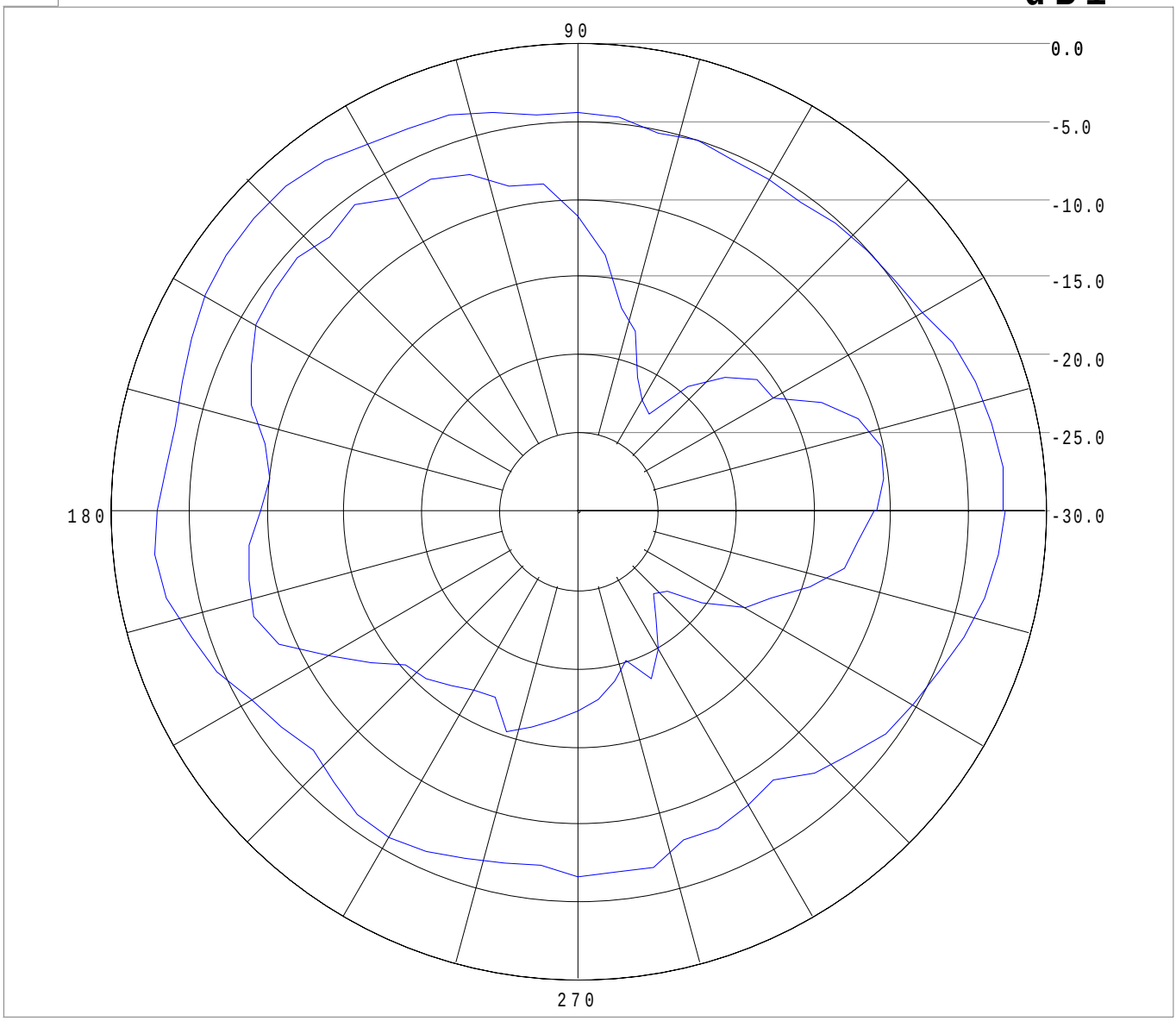
Data

Path: g:\Labview\data1\Norm\Toko\Toko Antenna.dat

Records: 6 6/22/99 8:43:08 AM

PEP

dBi



Run Info

Model: Toko Antenna S/N:

Version: Antenna Test Fixture

Ft(MHz): 2440 Harmonic: Fund. Polarity: Vert

Scale Max: 0.00

Scale Min: -30.00

Rec No. 3

Peak	mean	%
-1.90	-6.88	66

dBi

6/22/99 8:58:37 AM