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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247) & RSS-210

FCC ID: N73-MP70
Industry Canada ID: 7449B-MP70



Test Sample: Mine Phone
Model Number: MP70

Tested for: Mine Site Technologies Pty Ltd

Report Number: M120554R_Cert_MP70

Issue Date: 15th August 2012

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.

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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247) & RSS-210
EMC Technologies Report No. M120554R_Cert_MP70
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Attachment 1: RF Exposure Information

EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247) & RSS-210

Report Number: M120554R_Cert_MP70

Test Sample: Mine Phone
Model Number: MP70
Manufacturer: Mine Site Technologies China Co. Ltd

FCC ID: N73-MP70
Industry Canada ID: 7449B-MP70
Equipment Type: Intentional Radiator (Transceiver)

Tested for: Mine Site Technologies Pty Ltd
Address: 113, Wicks Road
Macquarie Park NSW 2113
Australia

Responsible Party: Cher Seong Phang

Test Standards: FCC Part 15 – Radio Frequency Devices
FCC Part 15 Subpart C - Intentional Radiators
Section 15.247: 2400 – 2483.5 MHz & 5725 – 5850 MHz Operation Bands
ANSI C63.4 – 2009
558074 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

RSS-210 Issue 8 Low Power Licence-Exempt RadioCommunication Devices Annex 8: 2400–2483.5 MHz & 5725–5850 MHz Operation Bands

RSS-GEN Issue 3 General Requirements and Information for the Certification of Radiocommunication Equipment

Test Dates: 3rd to 17th July 2012

Test Engineer: Chieu Huynh - B.Eng (Hons) Electronics

Attestation: *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*



Authorised Signatory: Chieu Huynh
Senior EMC Engineer
EMC Technologies Pty Ltd

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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247) & RSS-210

1.0 INTRODUCTION

EMI testing was performed on the MP70 Mine Phone in accordance with the Federal Communications Commission (FCC) regulations as detailed in Title 47 CFR, Part 15.247 Subpart C, intentional radiators.

The test sample was provided by the Client. The results herein apply only to the test sample.

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

47 CFR, Part 15, Subpart C:	Rules for intentional radiators (particularly section 15.247)
Section 15.203:	Antenna requirements
Section 15.205:	Restricted bands of operation
Section 15.207:	Conducted Emission Limits
Section 15.209:	Radiated Emission Limits (General requirements)
Section 15.247:	Operation in the band: 2400 - 2483.5 MHz

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.247.

The test sample also complied with the Industry Canada RSS-210 issue 8 - Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Annex 8 and RSS-Gen.

The measurement procedure used was in accordance with ANSI C63.4-2009. The instrumentation conformed to the requirements of ANSI C63.2-1996.



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1.1 Summary of Results

FCC Subpart C, Section 15.247

FCC Part 15 Subpart C Clauses	IC RSS-210 and RSS-Gen Clauses	Test Performed	Results
15.203	RSS-Gen (7.1.2)	Antenna Requirement	Complied
15.205	RSS-Gen (7.2.2)	Operation in Restricted Band	Complied
15.207	RSS-Gen (7.2.4)	Conducted Emissions	Complied
15.209	RSS-Gen (7.2.5)	Radiated Emissions	Complied
15.247 (a)(2)	A8.2 (a)	Channel Bandwidth	Complied
15.247 (b)(3)	A8.4 (4)	Peak Output Power	Complied
15.247 (c)	RSS-Gen (7.1.2)	Antenna Gain > 6 dBi	Not Applicable. Antenna gain < 6 dBi
15.247 (d)	A8.5	Out of Band Emissions	Complied
15.247 (e)	A8.2 (b)	Peak Power Spectral Density	Complied
15.247 (f)	A8.3	*Hybrid Systems	Not Applicable. EUT does not employ a hybrid system
15.247 (g)	A8.1	Frequency Hopping	Not Applicable. EUT does not employ frequency hopping
15.247 (h)	A8.1	Frequency Hopping	Not Applicable. EUT does not employ frequency hopping
15.247 (i)	RSS-Gen (5.6)	Radio Frequency Hazard	Complied

*Hybrid systems are those that employ a combination of both frequency hopping and digital modulations technique.

1.2 EUT – Voltage Power Conditions

The EUT was battery powered. The EUT can be recharge with its battery charger (AC/DC adaptor) and a charging dock. Radiated testing was performed in battery mode and a conducted emission was performed at a voltage of 120VAC at 60Hz.

1.3 Modifications by EMC Technologies

No modifications were required.



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2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 EUT Details

Test Sample:	Mine Phone
Model Number:	MP70
Frequency Band:	2.412 GHz – 2.462 GHz
Number of Channel:	11
Modulation Type:	DSSS, CCK (802.11b) and OFDM (802.11g)
Input Supply:	Lithium Polymer Battery Pack
AC/DC Adaptor:	Click Switching Power Supply
Model:	CPS008075100
Input Voltage:	100 – 240 VAC, 50/60Hz, 0.2A
Output Voltage:	7.5V DC, 1A
Docking Part #:	MP7007-1
S/N:	C1010200979

2.2 Test Sample Descriptions

The ImPact MinePhone Intrinsically Safe Wi-Fi Handset is a Voice over IP (VoIP) handset that operates over a Wi-Fi (802.11b/g wireless Ethernet) communications link. The handsets can provide voice and data communications, as well as positional information thanks to the in-built Wi-Fi tag.

2.3 Test Configuration

The EUT was configured in transmitting mode. Testing was performed on three channels (low, middle and high).

2.4 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-2009. Radiated emissions tests were performed at a distance of 3 metres from the EUT.

2.5 Test Facility

2.5.1 General

EMC Technologies Pty Ltd is listed by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies is listed as an FCC part 47CFR2.948 test lab and may perform the testing required under Parts 15 and 18 – **FCC Registration Number 90560**

EMC Technologies Pty Ltd has also been accredited as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) and Certification under Parts 15 & 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies open area test site (OATS) & indoor open area test site (iOATS) have been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional) - **Industry Canada OATS number - IC 3569B-1 & Industry Canada iOATS number - IC 3569B-2**

Measurements were performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia.

2.5.2 NATA Accreditation

EMC Technologies is accredited in Australia to test to the following standards by the National Association of Testing Authorities (NATA).

“FCC Part 15 unintentional and intentional emitters in the frequency range 9kHz to 18 GHz excluding TV receivers (15.117 and 15.119), TV interface devices (15.115), cable ready consumer electronic equipment (15.118), cable locating equipment (15.213) and unlicensed national information infrastructure devices (Sub part E).”

The current full scope of accreditation can be found on the NATA website: www.nata.asn.au
It also includes a large number of emissions, immunity, SAR, EMR and Safety standards.

NATA is the Australian national laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A²LA).

2.6 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd or the National Measurement Institute (NMI). All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NMI and the working antennas (loop, biconilog and horns) calibrated by the EMC Technologies. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in the Measurement Instrument Details.



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FCC 15.247 (DTS) RESULTS

3.0 CONDUCTED EMISSION MEASUREMENTS

Measurement was performed with a EUT in a charging dock and charging.

3.1 Test Procedure

The arrangement specified in ANSI C63.4-2009 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2-1996 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

3.2 Peak Maximising Procedure

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

3.3 Calculation of Voltage Levels

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

$$VEMI = VRx + LBPF$$

Where: **VEMI** = the Measured EMI voltage in dB μ V to be compared to the limit.
VRx = the Voltage in dB μ V read directly at the EMI receiver.
LBPF = the insertion loss in dB of the cables and the Limiter and Pass Filter.

3.4 Plotting of Conducted Emission Measurement Data

The measurement data pertaining to each frequency sub-range were concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

3.5 Results of Conducted Emission Measurement

Worst case emissions occurred at 0.418 MHz and complied with the FCC Class B, quasi peak and average limits by margins of 8.9 dB and 20 dB. Refer to Appendix H, Graphs 1 & 2.



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4.0 RADIATED SPURIOUS EMISSION MEASUREMENTS

4.1 Test Procedure

Testing was performed in accordance with the requirements of FCC Part 15.247(d).

Radiated emission measurements were performed to the limits as per section 15.209 and 15.247. All measurements were made over a distance of 3 metres.

The EUT was set up on the table top (placed on turntable) of total height 80 cm above the ground plane, and operated as described in section 2 of this report. The test frequency range was subdivided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated loop antenna was used for measurements between 0.009 MHz to 30 MHz. A calibrated biconilog antenna used for measurements between 30 MHz to 1000 MHz. Calibrated EMCO 3115, EMCO 3116 and ETS standard gain horn antennas were used for measurements between 1 to 25 GHz.

The following bandwidth settings were used:

RBW = 1 kHz and VBW = 3 kHz for frequency band 9 kHz – 150 kHz

RBW = 9 kHz and VBW = 30 kHz for frequency band 150 kHz – 30 MHz

RBW = 120 kHz and VBW = 300 kHz for frequency band 30 MHz – 1000 MHz

RBW = 200 Hz and VBW = 10 Hz for frequency bands 9 kHz – 90 kHz and 110 kHz – 490 kHz

Peak measurements above 1 GHz: RBW = VBW = 1 MHz

Average measurements above 1 GHz: RBW = 1 MHz and VBW = 10 Hz

The receiver bandwidth was set to 6 dB.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable, and by varying the antenna height. Each significant peak was investigated with the Peak/Average Detectors. The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both horizontal and vertical antenna polarisations.

4.2 Calculation of field strength

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

E = V + AF - G + L Where:

E = Radiated Field Strength in dB μ V/m.

V = EMI Receiver Voltage in dB μ V. (measured value)

AF = Antenna Factor in dB(m⁻¹). (stored as a data array)

G = Preamplifier Gain in dB. (stored as a data array)

L = Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)

- **Example Field Strength Calculation**

Assuming a receiver reading of 34.0 dB μ V is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

$$34.0 + 9.2 + 1.9 - 20 = 25.1 \text{ dB}\mu\text{V/m}$$



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4.3 Radiated Emissions (Spurious and Harmonics)

Measurements were performed while the transmitter transmitting.

Initial investigations were performed with all data rates. Final testing was performed while the transmitter continuously operated in the worst case condition.

All orientations were investigated and tested. Worst results were reported below.

4.3.1 Frequency Band: 1 – 25 GHz

The 74 dB μ V/m @ 3m (peak) and 54 dB μ V/m @ 3m (average) limits are applied for emissions fall in the restricted bands. The limits for emission outside the restricted band are 20 dB below the fundamental field strength.

4.3.1.1 Configuration 802.11b

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2412	Fundamental Frequency				
4824	58.6	47.7	74.0	54.0	Complied
2390	61.1	48.5	74.0	54.0	Complied

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2437	Fundamental Frequency				
4874	Same or lower than channel 1				Complied

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2462	Fundamental Frequency				
4924	Same or lower than channel 1				Complied
2483.5	60.2	48.1	74.0	54.0	Complied

Result: Harmonic was recorded up to 25 GHz. Other harmonics were confirmed low with both RBW and VBW reduced. The worst case emissions complied with the FCC limits of sections 15.209 and 15.247 by a margin of 6.3 dB.

4.3.1.2 Configuration 802.11g

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2412	Fundamental Frequency				
4824	60.7	38.1	74.0	54.0	Complied
2390	67.3	41.1	74.0	54.0	Complied

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2437	Fundamental Frequency				
4874	Same or lower than channel 1				Complied

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2462	Fundamental Frequency				
4924	Same or lower than channel 1				Complied
2483.5	63.5	39.7	74.0	54.0	Complied

Result: Harmonic was recorded up to 25 GHz. Other harmonics were confirmed low with both RBW and VBW reduced. The worst case emissions complied with the FCC limits of sections 15.209 and 15.247 by a margin of 6.7 dB.

4.3.2 Frequency Band: 30 - 1000 MHz

All emissions complied with the FCC 15.209 limits by margins of greater than 10 dB. Refer to Appendix H, Graphs 3 and 4.

4.3.3 Frequency Band: 0.009 - 30 MHz

All emissions complied with the FCC 15.209 limits by margins of greater than 10 dB. Refer to Appendix H, Graph 5.



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5.0 PEAK OUTPUT POWER - Section 15.247 (b)(3)

Measurements were performed while the transmitter transmitting.

Initial investigations were performed with all data rates. Final testing was performed while the transmitter continuously operated in the worst case condition.

The maximum antenna gain was less than 6 dBi.

The peak output power measurement was performed as per 5.2.1.2 Measurement Procedure PK2 of FCC 558074 DTS measurements guidance. The resolution bandwidth of 1 MHz and video bandwidth of 3 MHz were used.

5.1 Configuration 802.11b

Frequency MHz	Antenna Gain dBi	P dBm	Limit dBm	Result
2412	5.16	16.9	30	Complied
2437		16.4		
2462		15.8		

5.2 Configuration 802.11g

Frequency MHz	Antenna Gain dBi	P dBm	Limit dBm	Result
2412	5.16	18.8	30	Complied
2437		18.4		
2462		17.3		



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6.0 CHANNEL BANDWIDTH

Measurements were performed while the transmitter transmitting.

The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were used.

6.1 Configuration 802.11b

Frequency MHz	6 dB BW MHz	99% BW MHz	Limit	Result
2412	12.24	15.48	At least 500 kHz	Complied
2437	12.18	15.66		
2462	12.06	15.60		

Refer to Appendix I for bandwidth plots

6.2 Configuration 802.11g

Frequency MHz	6 dB BW MHz	99% BW MHz	Limit	Result
2412	16.32	16.50	At least 500 kHz	Complied
2437	16.32	16.44		
2462	16.26	16.44		

Refer to Appendix I for bandwidth plots

7.0 PEAK POWER SPECTRAL DENSITY

Testing was performed accordance with the requirements of FCC Part 15.247(e)

The peak power spectral density measurement was performed as per 5.3.1 Measurement Procedure PKPSD of FCC 558074 DTS measurements guidance. The resolution bandwidth of 100 kHz and video bandwidth of 300 kHz were used. The results are scale down by 15.2 dB.

7.1 Configuration 802.11b

Frequency MHz	Antenna Gain dBi	PD dBm	PD - 15.2dB dBm	Limit dBm	Result
2412	5.16	2.23	-12.97	8	Complied
2437		2.25	-12.95		
2462		2.23	-12.97		

Refer to Appendix J for spectral density plots

7.2 Configuration 802.11g

Frequency MHz	Antenna Gain dBi	PD dBm	PD - 15.2dB dBm	Limit dBm	Result
2412	5.16	4.0	-11.2	8	Complied
2437		2.44	-12.76		
2462		0.11	-15.09		

Refer to Appendix J for spectral density plots



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8.0 RADIO FREQUENCY EXPOSURE (HAZARD) INFORMATION

Spread spectrum transmitters operating in the 2400 - 2483.5 MHz band is required to be operated in a manner that ensures that the public is not exposed to RF energy levels in accordance with CFR 47, Section 1.1307(b)(1).

In accordance with this section and also section 2.1093 this device has been defined as a portable device.

SAR testing was performed in accordance with OET Bulletin 65 and reported under EMC Technologies report M120604_FCC_SAR. SAR value of 0.057 mW/g was measured which complied with the FCC human exposure requirements of 47 CFR 2.1093 (d).

9.0 ANTENNA REQUIREMENT

This intentional radiator was designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

10.0 COMPLIANCE STATEMENT

The MP70 Mine Phone, **complied** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.247 - Operation in the frequency bands 2400 - 2483.5 MHz and 5725 – 5850 MHz.

The test sample also complied with the Industry Canada RSS-210 issue 8 - Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Annex 8 and RSS-Gen.

Results were as follows:

FCC Part 15 Subpart C Clauses	IC RSS-210 and RSS-Gen Clauses	Test Performed	Results
15.203	RSS-Gen (7.1.2)	Antenna Requirement	Complied
15.205	RSS-Gen (7.2.2)	Operation in Restricted Band	Complied
15.207	RSS-Gen (7.2.4)	Conducted Emissions	Complied
15.209	RSS-Gen (7.2.5)	Radiated Emissions	Complied
15.247 (a)(2)	A8.2 (a)	Channel Bandwidth	Complied
15.247 (b)(3)	A8.4 (4)	Peak Output Power	Complied
15.247 (c)	RSS-Gen (7.1.2)	Antenna Gain > 6 dBi	Not Applicable. Antenna gain < 6 dBi
15.247 (d)	A8.5	Out of Band Emissions	Complied
15.247 (e)	A8.2 (b)	Peak Power Spectral Density	Complied
15.247 (f)	A8.3	*Hybrid Systems	Not Applicable. EUT does not employ a hybrid system
15.247 (g)	A8.1	Frequency Hopping	Not Applicable. EUT does not employ frequency hopping
15.247 (h)	A8.1	Frequency Hopping	Not Applicable. EUT does not employ frequency hopping
15.247 (i)	RSS-Gen (5.6)	Radio Frequency Hazard	Complied

*Hybrid systems are those that employ a combination of both frequency hopping and digital modulations technique.



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11.0 MEASUREMENT UNCERTAINTIES

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainties for emissions tests shown within this report are as follows:

Conducted Emissions:	9 kHz to 30 MHz	±3.2 dB
Radiated Emissions:	9 kHz to 30 MHz	±4.1 dB
	30 MHz to 300 MHz	±5.1 dB
	300 MHz to 1000 MHz	±4.7 dB
	1 GHz to 18 GHz	±4.6 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

12.0 MEASUREMENT INSTRUMENT

EQUIPMENT TYPE	MANUFACTURER, MODEL NUMBER and SERIAL NUMBER	CALIBRATION DUE DD/MM/YY
EMI RECEIVER	Rohde & Schwarz, Model ESU40 SN 1302.6005.40, 20 Hz – 40 GHz	13/01/13
	HP 8546A Sn: 3549A00290 (R-009)	11/08/12
ANTENNAS	Narda Standard Gain Horn, M/N: 644	19/11/12
	ETS Standard Gain Horn, M/N: 3160-03	19/11/12
	ETS Standard Gain Horn, M/N: 3160-05	19/11/12
	ETS Standard Gain Horn, M/N: 3160-06	19/11/12
	ETS Standard Gain Horn, M/N: 3160-07	19/11/12
	ETS Standard Gain Horn, M/N: 3160-08	19/11/12
	ETS Standard Gain Horn, M/N: 3160-09	08/02/14
	EMCO 6502 LOOP ANTENNA 9 kHz – 30 MHz Sn: 2021	19/11/12
	Sunol Sciences Corp (USA) JB6 Biconilog 30 MHz - 6 GHz Sn: A012312	02/02/13
EMCO 3115 DOUBLE RIDGED HORN 1 - 18 GHz Sn: 8908-3282	16/01/15	
LISN	EMCO 3816/2, Sn: 4139-0310-01	15/09/12
LIMITER	HP LIMITER TRANSIENT (9 kHz – 200 MHz) 11947A Sn. 3107A02888	18/08/12



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