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DATE: 12 January 2017

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

For

Orpak Systems Ltd.

Equipment under test:

Outdoor Payment Terminal

OrPAY1000
(Zigbee 2.4GHz)

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

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This report relates only to items tested.

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Measurement/Technical Report for

Orpak Systems Ltd.

Outdoor Payment Terminal

OrPAY1000

FCC ID: W8F800927850

This report concerns:	Original Grant:	X
	Class I Change:	
	Class II Change:	
Equipment type:	Digital Transmission System	
Limits used:	47CFR15 Section 15.247	

Measurement procedure used is KDB 558074 D01 v03r03 and ANSI C63.10-2013.

Application for Certification prepared by:

R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva Street
Lod, 7120101
Israel
e-mail Rpinchuck@itl.co.il

Applicant for this device:
(different from "prepared by")

Yair Elul
Orpak Systems Ltd.
31 Lechi St.
P.O.B. 1461
Bnei-Brak, 51114
Israel
Tel: +972- 3 - 577 - 6868
Fax: +972- 3 - 579 - 6310
e-mail: yairelul@orpak.com

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1. General Information

1.1 *Administrative Information*

Manufacturer:	Orpak Systems Ltd.
Manufacturer's Address:	31 Lechi St. P.O.B. 1461 Bnei-Brak, 51114 Israel Tel: +972-3-577-6868 Fax: +972-3-579-6310
Manufacturer's Representative:	Haim Aharon
Equipment Under Test (E.U.T):	Outdoor Payment Terminal
Equipment Model No.:	OrPAY1000,
Equipment Serial No.:	1021266
Date of Receipt of E.U.T:	07.08.2016
Start of Test:	08.08.2016
End of Test:	18.08.2016
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C, Section 15.247

1.2 *List of Accreditations*

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, IC 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 *Product Description*

The OrPAY 1000 is a cost-effective outdoor payment terminal installed directly onto the dispenser or wall mounted next to it for both attended and unattended activities.

The terminal's unique features have been designed to suit both retail and commercial fleet markets as an impeccable pay-at-the-pump solution for fuel card purchases, forecourt promotions, local accounts, loyalty schemes, attendant management, and much more.

In addition, OrPAY1000 has a built-in 'pump interface', allowing it to control the dispenser as well as interface directly with Orpak's forecourt controller over LAN, eliminating the need for dedicated pump interface hardware.

The OrPAY 1000 terminal is small enough to fit in any standard pump head or pedestal, yet provides an efficient and advanced user interface with its 4.3" multimedia color LCD display, 4 addressable screen keys, and a full alphanumeric vandal proof 40-key keyboard. Furthermore, the novel terminal can be part of Orpak's ForeFuel solution with its built-in WGT (Wireless Gateway).

Model name	Orpay-1000
Working voltage	12.0-24.0V DC via AC/DC adapter Manufactory: mean well Order num: GS40A24-P1j s/n : EB58E77878
Mode of operation	Transceiver
Modulations	IEEE 802.15.4 (ZIGBEE)
Assigned Frequency Range	2400.0-2483.5MHz
Operating Frequency Range	2405.0-2480.0MHz
Transmit power	~4.4dBm
Antenna Gain	+3.3dBi; +5.3dBi
Modulation BW	>500kHz
Number of antennas	2 for diversity

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r03 and ANSI C63.4: 2014. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 *Test Facility*

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 *Measurement Uncertainty*

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)
0.15 – 30 MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 3.44 dB

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

2. System Test Configuration

2.1 *Justification*

Testing was performed with the E.U.T's orientation in installation position as defined by the customer.
The unit was tested while transmitting at the low (2405.0MHz), mid (2440.0MHz) and high channel (2480.0MHz) in IEEE 802.15.4 technology (ZIGBEE).

Exploratory emission testing was performed with 2 antennas to determine the maximum fundamental emission.

The 2 antennas are used for diversity. The E.U.T. operates using the +3.3dBi antenna and if necessary switches automatically to use the +5.3dBi antenna.

The results are shown in the below table:

FREQ	Antenna A (+3.3dBi)		Antenna B (+5.3dBi)	
	V dBµV/m	H dBµV/m	V dBµV/m	H dBµV/m
2405.0MHz	87.6	88.1	93.9	95.5
2440.0MHz	88.3	89.7	92.6	95.3
2480.0MHz	87.0	87.1	**95.7**	95.4

Figure 1. Screening Results

According to above results, the worst case was with antenna B.

The E.U.T was tested with RS485 sub board.

2.2 *EUT Exercise Software*

No special exercise software was used.

2.3 *Special Accessories*

No special accessories were needed to achieve compliance.

2.4 *Equipment Modifications*

No modifications were necessary in order to achieve compliance.

2.5 *Configuration of Tested System*

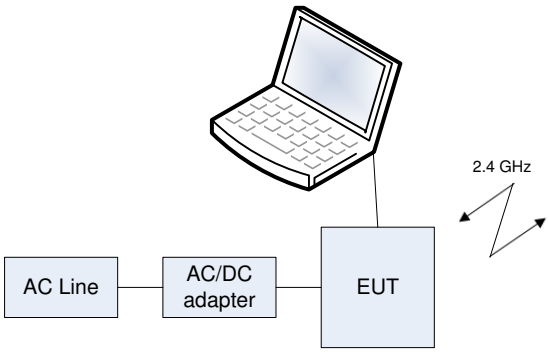

Figure 2. Configuration of Tested System

3. Conducted & Radiated Measurement Test Set-Up Photos

Figure 3. Conducted Emission Test

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

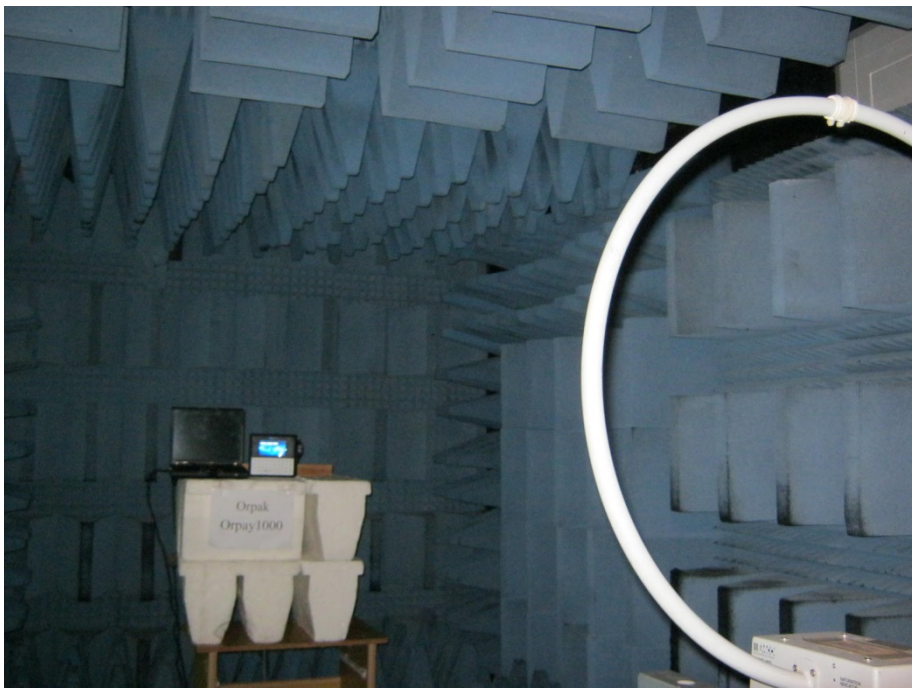

Figure 6. Radiated Emission Test

Figure 7. Radiated Emission Test

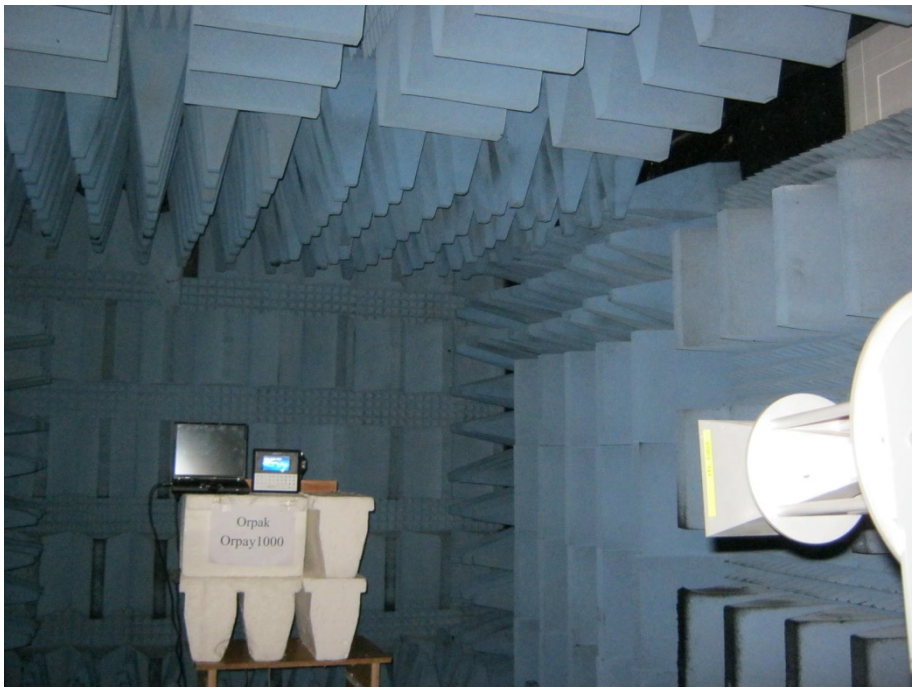

Figure 8. Radiated Emission Test

4. Conducted Emission From AC Mains

4.1 *Test Specification*

FCC Part 15, Subpart C, Section 15.207

4.2 *Test Procedure*

(Temperature (22°C)/ Humidity (60%RH))

The E.U.T operation mode and test setup are as described in Section 2 of this report. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on a 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 3. Conducted Emission Test.*

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver and are displayed on the receiver's spectrum display.

The E.U.T was tested while transmitting simultaneously at ZIGBEE, 125 kHz and 13.56 MHz.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 *Test Limit*

Frequency of emission (MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	Average
0.15-0.5	66.0 to 56.0*	56.0 to 46.0*
0.5-5.0	56.0	46.0
5.0-30.0	60.0	50.0

* Decreases with the logarithm of the frequency.

4.4 *Test Results*

JUDGEMENT: Passed by 2.76 dB

The margin between the emission levels and the specification limit is, in the worst case, 2.8 dB for the phase line at 0.41 MHz and 3.8 dB at 0.41 MHz for the neutral line.

The EUT met the F.C.C. Part 15, Subpart C specification requirements.

The details of the highest emissions are given in *Figure 9* to *Figure 12*.

Conducted Emission

E.U.T Description	Outdoor Payment Terminal
Type	OrPAY1000
Serial Number:	1021266

Specification:	FCC Part 15, Subpart C
Lead:	Phase
Detectors: :	Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2	Average	206 kHz	44.40	-8.95
1	Quasi Peak	210 kHz	52.44	-10.76
1	Quasi Peak	410 kHz	54.88	-2.76
2	Average	410 kHz	43.09	-4.55
1	Quasi Peak	450 kHz	49.74	-7.13
2	Average	454 kHz	35.50	-11.30
2	Average	1.13 MHz	29.69	-16.30
1	Quasi Peak	1.146 MHz	40.79	-15.20
1	Quasi Peak	1.554 MHz	39.13	-16.86
2	Average	1.666 MHz	28.93	-17.06
2	Average	2.178 MHz	26.10	-19.89
1	Quasi Peak	2.878 MHz	30.83	-25.16
1	Quasi Peak	4.13 MHz	30.00	-25.99
2	Average	4.182 MHz	25.84	-20.15
2	Average	10.322 MHz	26.54	-23.45
1	Quasi Peak	10.358 MHz	30.16	-29.83
1	Quasi Peak	13.57 MHz	32.22	-27.77
2	Average	13.57 MHz	27.10	-22.89
2	Average	17.682 MHz	25.95	-24.04
1	Quasi Peak	18.55 MHz	29.13	-30.86

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Figure 9. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	Outdoor Payment Terminal
Type	OrPAY1000
Serial Number:	1021266

Specification:	FCC Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Average

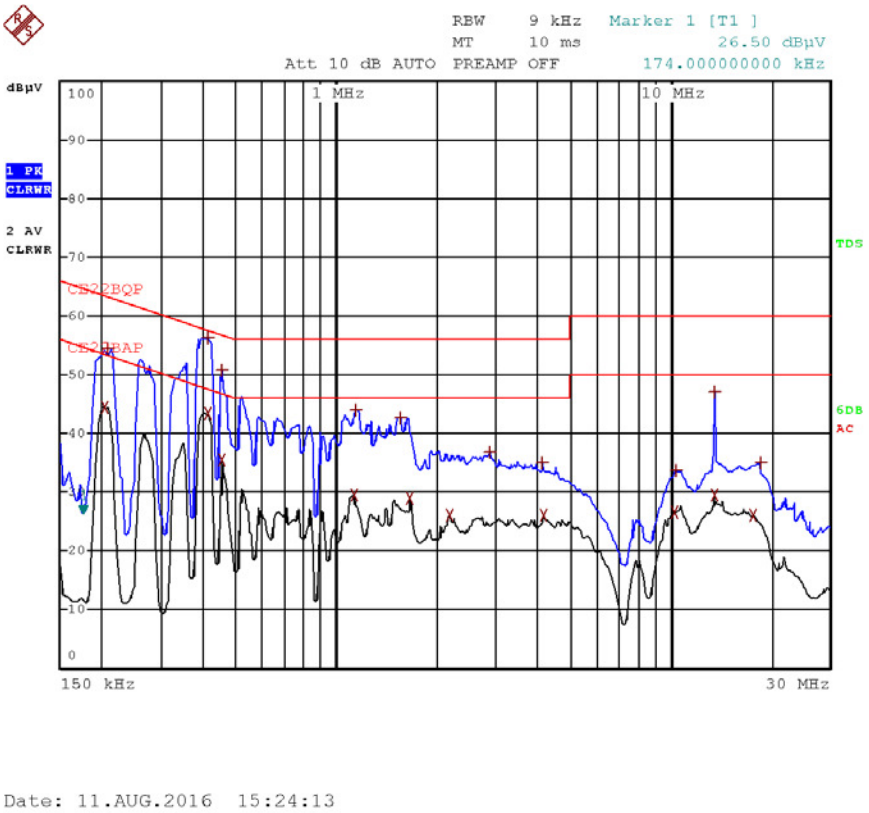

Figure 10. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	Outdoor Payment Terminal
Type	OrPAY1000
Serial Number:	1021266

Specification:	FCC Part 15, Subpart C
Lead:	Neutral
Detectors:	Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2	Average	202 kHz	43.66	-9.86
1	Quasi Peak	214 kHz	50.58	-12.46
2	Average	394 kHz	42.48	-5.49
1	Quasi Peak	410 kHz	53.88	-3.75
1	Quasi Peak	450 kHz	48.80	-8.07
2	Average	454 kHz	34.58	-12.22
2	Average	1.13 MHz	28.61	-17.38
1	Quasi Peak	1.162 MHz	39.92	-16.07
1	Quasi Peak	1.554 MHz	38.05	-17.94
2	Average	1.666 MHz	27.79	-18.21
2	Average	2.178 MHz	25.20	-20.79
1	Quasi Peak	2.338 MHz	32.25	-23.75
1	Quasi Peak	4.126 MHz	30.44	-25.55
2	Average	4.25 MHz	25.47	-20.53
2	Average	10.354 MHz	26.98	-23.01
1	Quasi Peak	10.394 MHz	30.88	-29.11
1	Quasi Peak	13.566 MHz	44.56	-15.43
2	Average	13.566 MHz	30.38	-19.61
2	Average	17.746 MHz	26.22	-23.77
1	Quasi Peak	18.342 MHz	30.49	-29.51

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Figure 11. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	Outdoor Payment Terminal
Type	OrPAY1000
Serial Number:	1021266

Specification:	FCC Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Average

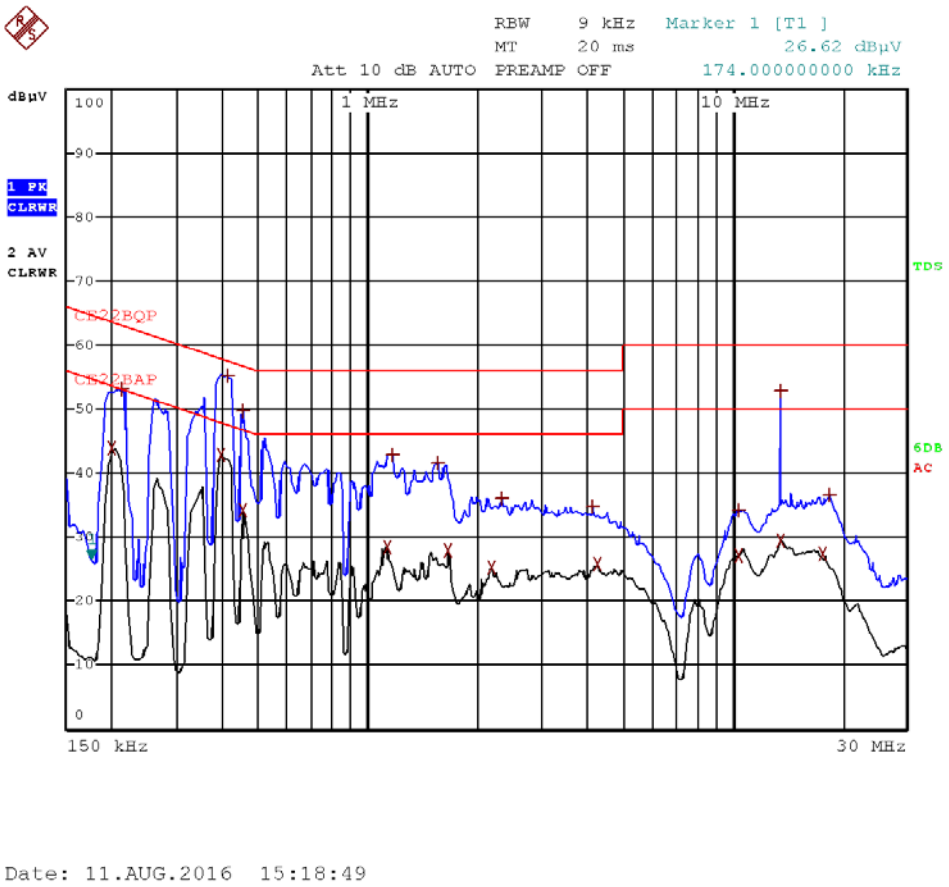

Figure 12 Detectors: Peak, Quasi-peak, Average

4.5 *Test Equipment Used; Conducted Emission*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
LISN	Fischer	FCC-LISN-25A	127	June 23, 2016	June 23, 2017
Transient Limiter	HP	11947A	3107A03041	June 15, 2016	June 15, 2017
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 29, 2016	March 1, 2017

Figure 13 Test Equipment Used

5. 6 dB Minimum Bandwidth

5.1 *Test Specification*

FCC Part 15, Subpart C, Section 247(a)(2)

5.2 *Test Procedure*

(Temperature (22°C)/ Humidity (53%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 2*.

The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

5.3 *Test Limit*

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.4 *Test Results*

Operation Frequency	Reading	Specification
(MHz)	(MHz)	(MHz)
2405.0	1.6	≥0.5
2440.0	1.6	≥0.5
2480.0	1.6	≥0.5

Figure 14 6 dB Minimum Bandwidth

JUDGEMENT: Passed

For additional information see *Figure 15* to *Figure 17*.

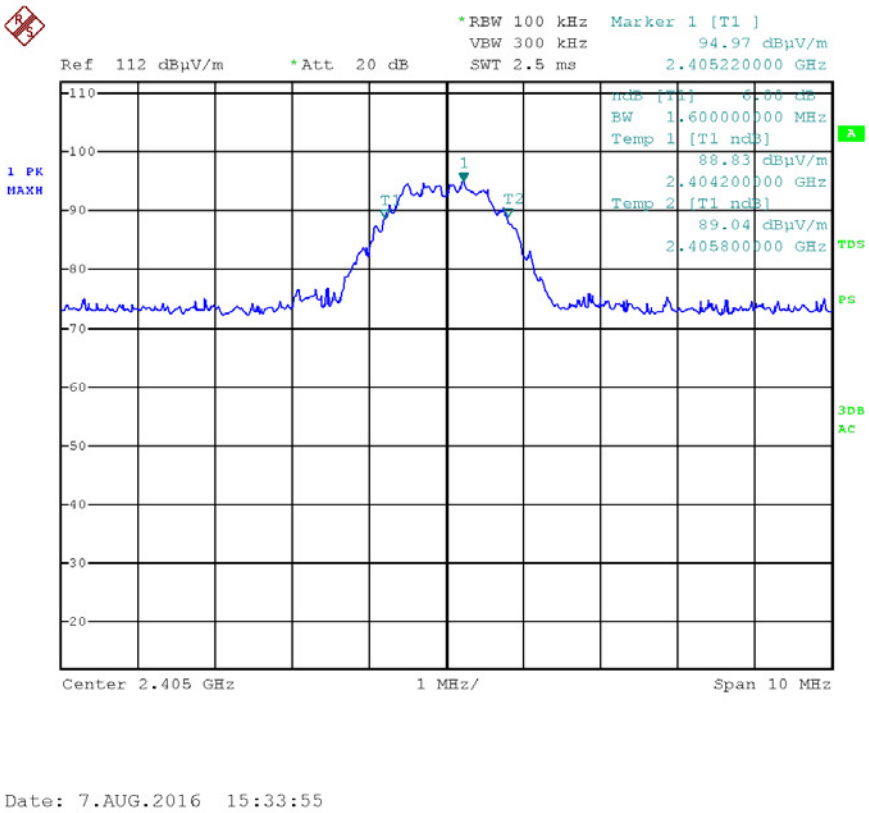

Figure 15. – 6dB Minimum Bandwidth - 2405.0 MHz

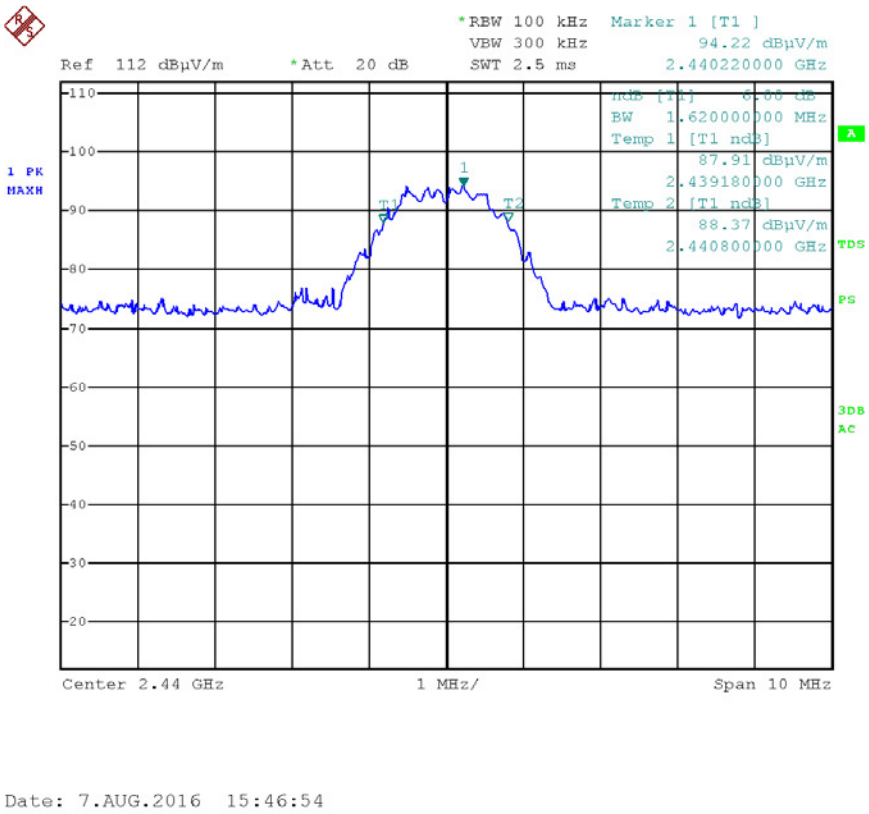

Figure 16. 6dB Minimum Bandwidth - 2440.0 MHz

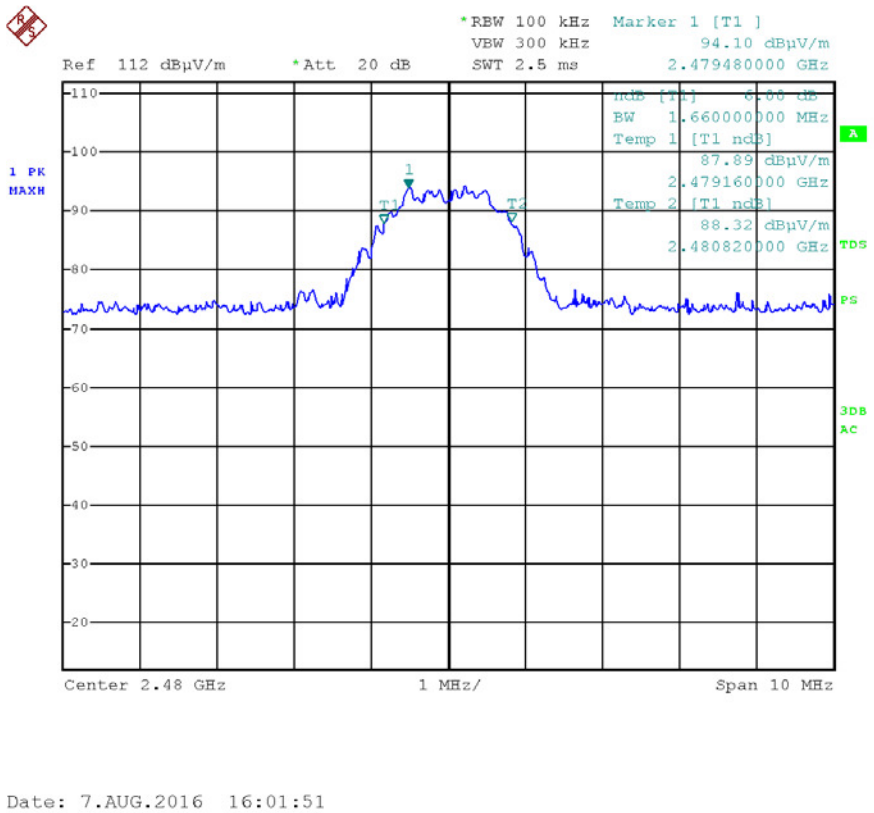

Figure 17. 6dB Minimum Bandwidth - 2480.0 MHz

5.5 *Test Equipment Used; 6dB Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 18 Test Equipment Used

6. Maximum Transmitted Peak Power Output

6.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(b)(3)

6.2 *Test Procedure*

(Temperature (22°C)/ Humidity (53%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The distance between the E.U.T to the test antenna was 3m.

The configuration tested is shown in *Figure* 2.

The E.U.T was evaluated in 3 channels: Low (2405.0 MHz), Mid (2440.0 MHz) and High (2480.0 MHz).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \quad [W]$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

6.3 *Test Limit*

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt.

6.4 *Test Results*

Operation Frequency	Polarization	Power	Power	Power	Limit	Margin
(MHz)	(V/H)	(dBuV/m)	(dBm)	(mW)	(mW)	(mW)
2405.0	V	98.9	3.7	2.34	1000.0	-997.66
	H	99.6	4.4	2.75	1000.0	-997.25
2440.0	V	97.0	1.8	1.51	1000.0	-998.49
	H	99.5	4.3	2.69	1000.0	-997.31
2480.0	V	95.7	0.5	1.12	1000.0	-998.88
	H	99.5	4.3	2.69	1000.0	-997.31

Figure 19 Maximum Peak Power Output

JUDGEMENT: Passed by 997.25 mW

For additional information see *Figure 20* to *Figure 25*.

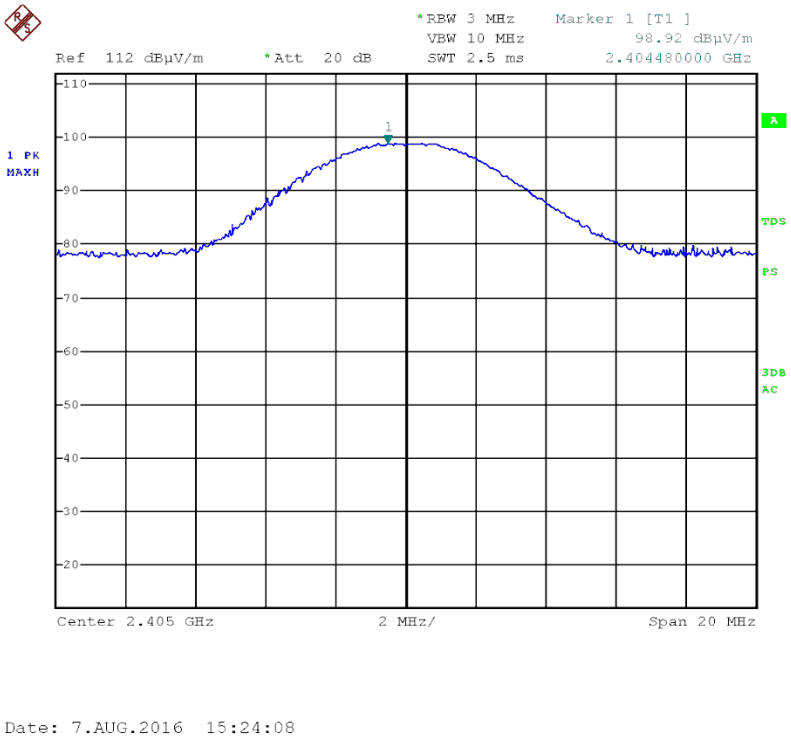

Figure 20 Maximum Peak Power - 2405.0 MHz – Vertical

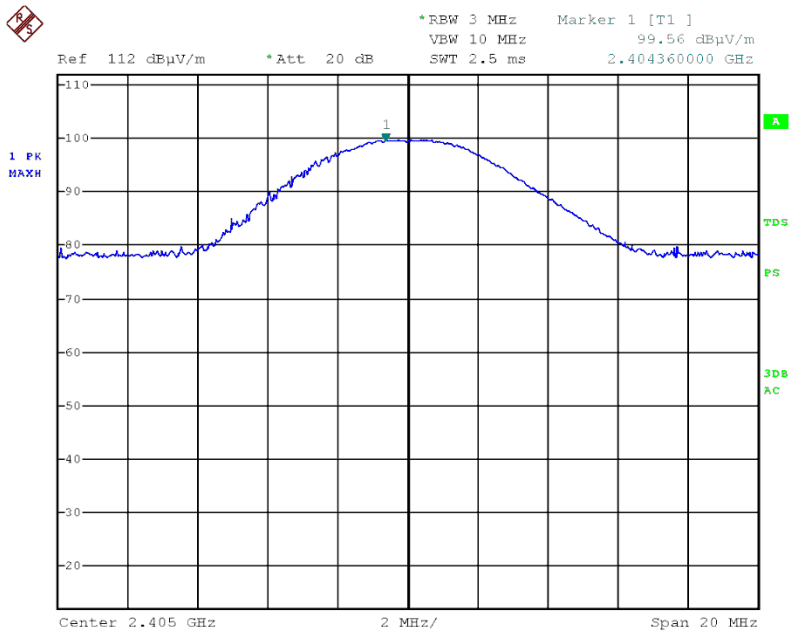

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Figure 21 Maximum Peak Power -2405.0 MHz – Horizontal

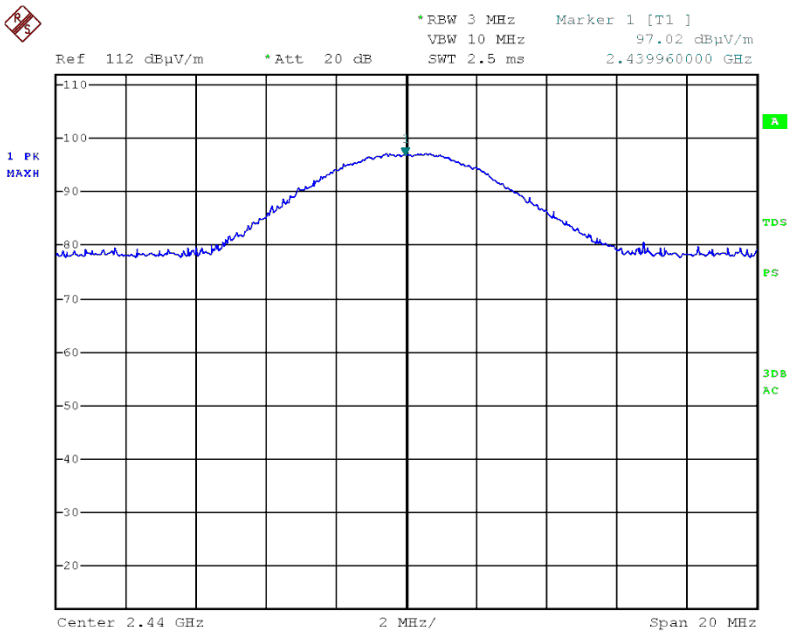

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Figure 22 Maximum Peak Power - 2440.0 MHz – Vertical

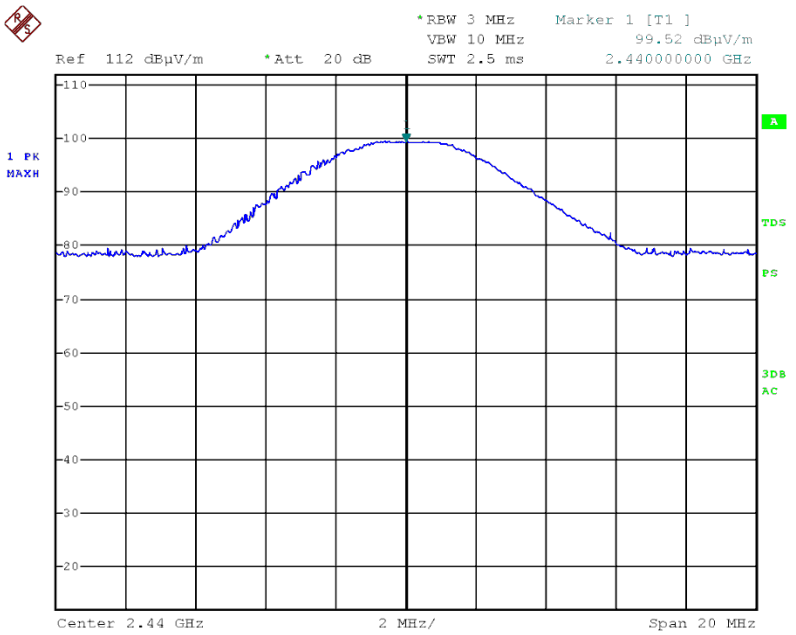

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Figure 23 Maximum Peak Power - 2440.0 MHz – Horizontal

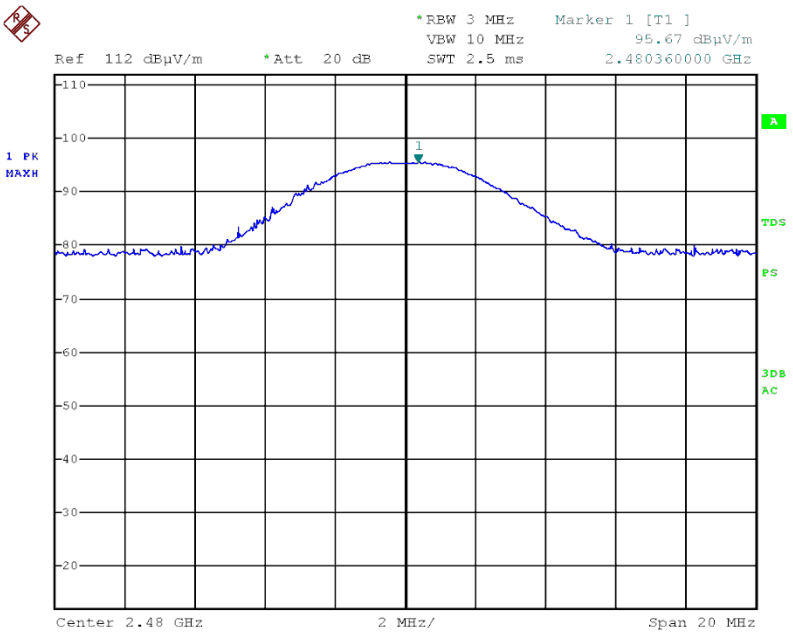

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Figure 24 Maximum Peak Power - 2480.0 MHz – Vertical

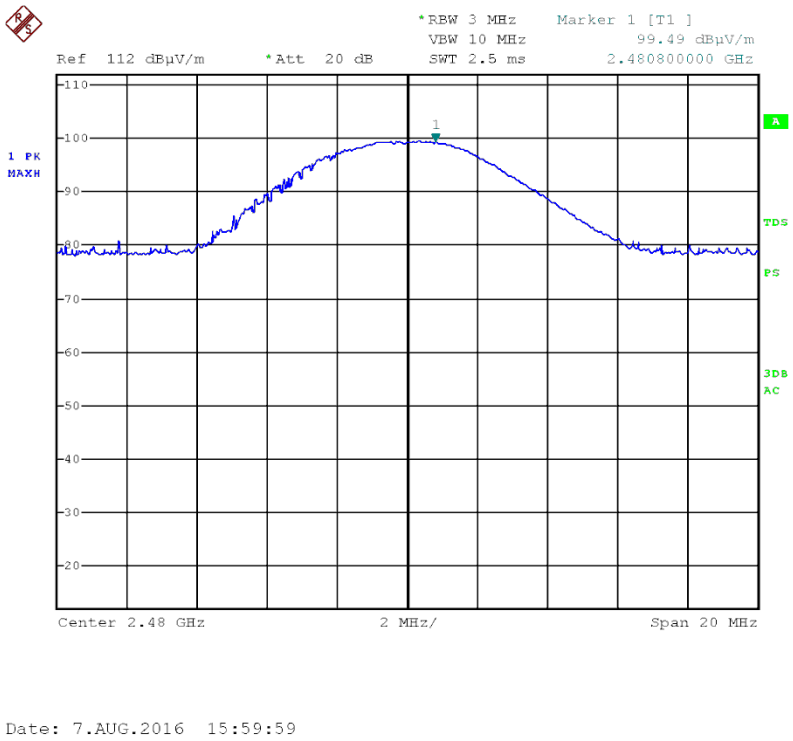

Figure 25 Maximum Peak Power - 2480.0 MHz – Horizontal

6.5 *Test Equipment Used; Maximum Peak Power Output*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 26 Test Equipment Used

7. Band Edge Spectrum

7.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(d)

7.2 *Test Procedure*

(Temperature (22°C)/ Humidity (59%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure* 2.

The RBW was set to 100 kHz.

7.3 *Test Limit*

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

7.4 *Test Results*

Operation Frequency	Band Edge Frequency	Spectrum Level	Limit	Margin
(MHz)	(MHz)	(dBuV/m)	(dBuV/m)	(dB)
2405.0	2400.0	64.2	75.0	-10.8
2480.0	2483.5	63.8	74.0	-10.2

Figure 27 Band Edge Spectrum

JUDGEMENT: Passed by 10.2 dB

For additional information see *Figure 28* and *Figure 29.*

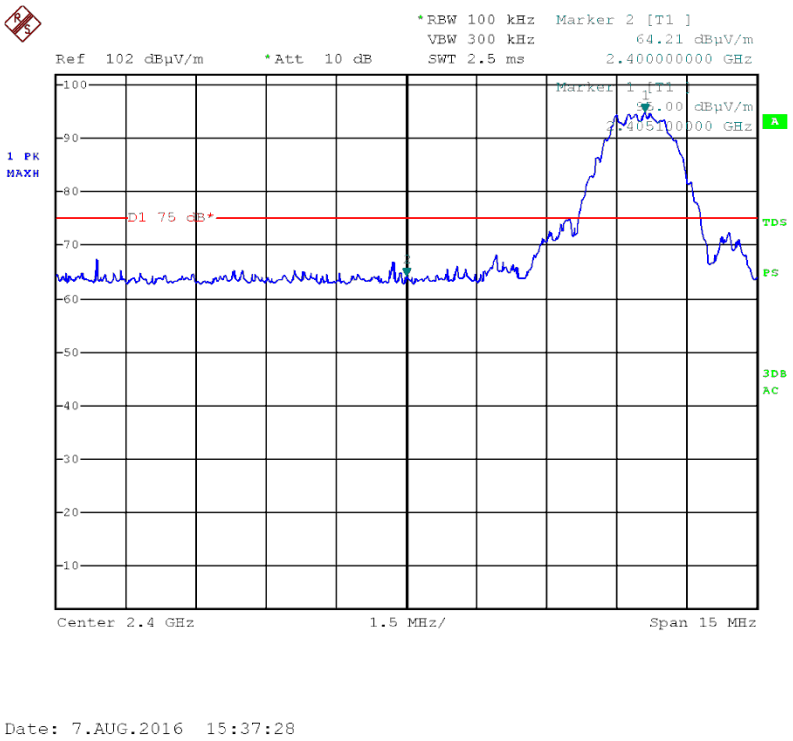

Figure 28 —Lower Band Edge

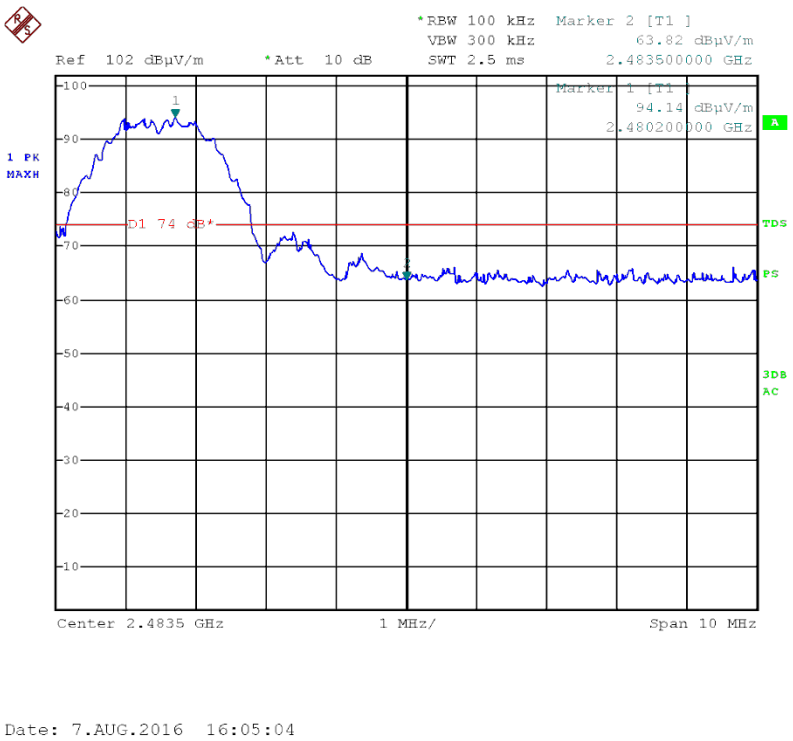

Figure 29 —Upper Band Edge

7.5 *Test Equipment Used; Band Edge Spectrum*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 30 Test Equipment Used

8. Emissions in Non-Restricted Frequency Bands

8.1 *Test Specification*

FCC Part 15, Subpart C, Section 247(d)

8.2 *Test Procedure*

(Temperature (23°C)/ Humidity (60%RH))
The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

For measurements between 0.009MHz-30.0MHz:

The E.U.T was tested inside the chamber at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 30.0MHz-1.0GHz:
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 1.0GHz-25.0GHz:

The E.U.T was tested inside the chamber at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -25.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

RBW was set to 100 kHz.
The E.U.T. was operated at the low, mid and high channels (2405.0 MHz, 2440 MHz and 2480.0 MHz).

8.3 *Test Limit*

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

8.4 *Test Results*

JUDGEMENT: Passed

All signals were below the EMI receiver noise level which is at least 6dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) specification.

8.5 *Test Instrumentation Used, Emission in Non Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Spectrum Analyzer	HP	8593EM	3536A00120ADI	March 10, 2016	March 10, 2017
EMI Receiver	HP	8542E	3906A00276	March3, 2016	March3, 2017
RF Filter Section	HP	85420E	3705A00248	March3, 2016	March3, 2017
Spectrum Analyzer	HP	8564E	3442A00275	March 10, 2016	March 10, 2017
Biconical Antenna	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Active Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 5, 2016
Log Periodic Antenna	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	September 30, 2016
Low Noise Amplifier Chain	HP + Miteq	AFSX4-02001800-50-8P	-	July 20, 2016	July 20, 2017
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 31 Test Equipment Used

8.6 *Field Strength Calculation*

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors", using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dBμv/m]
RA: Receiver Amplitude [dBμv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

9. Emissions in Restricted Frequency Bands

9.1 *Test Specification*

FCC Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

9.2 *Test Procedure*

(Temperature (23°C)/ Humidity (60%RH))

For measurements between 0.009MHz-30.0MHz:

The E.U.T was tested inside the chamber at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 30.0MHz-1.0GHz:
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 1.0GHz-25.0GHz:

The E.U.T was tested inside the chamber at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -25.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

The E.U.T. was operated at the low, mid and high channels. (2405, 2440, 2480 MHz).

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

9.3 *Test Limit*

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength (dBµV/m)	Field strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 32 Table of Limits

9.4 *Test Results*

JUDGEMENT: Passed by 0.4dB

For the operation frequency of 2405 MHz, the margin between the emission level and the specification limit is in the worst case 2.5dB at the frequency of 2390.0 MHz, vertical polarization.

For the operation frequency of 2440 MHz, the margin between the emission level and the specification limit is in the worst case 13.0dB at the frequency of 4880.0 MHz, horizontal polarization.

For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is in the worst case 0.4dB at the frequency of 2483.5 MHz, horizontal polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C specification.

The details of the highest emissions are given in *Figure 33* to *Figure 34*.

Radiated Emission

E.U.T Description Outdoor Payment Terminal
Type OrPAY1000
Serial Number: 1021266

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters

Frequency range: 0.009MHz to 25.0 GHz
Detector: Peak

Operation Frequency	Freq.	Polarity	Peak Reading	Peak Limit	Peak Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB)
2405.0	2390.0	H	63.8	74.0	-10.2
2405.0	2390.0	V	63.8	74.0	-10.2
2405.0	4810.0	H	56.7	74.0	-17.3
2405.0	4810.0	V	57.0	74.0	-17.0
2440.0	4880.0	H	58.0	74.0	-16.0
2440.0	4880.0	V	57.6	74.0	-16.4
2480.0	4960.0	H	59.7	74.0	-14.3
2480.0	4960.0	V	59.6	74.0	-14.4
2480.0	2483.5	H	70.3	74.0	-3.7
2480.0	2483.5	V	67.3	74.0	-6.7

Figure 33. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission

E.U.T Description Outdoor Payment Terminal
Type OrPAY1000
Serial Number: 1021266

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 0.009MHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average

Operation Frequency	Freq.	Polarity	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB)
2405.0	2390.0	H	51.3	54.0	-2.7
2405.0	2390.0	V	51.5	54.0	-2.5
2405.0	4810.0	H	40.8	54.0	-13.2
2405.0	4810.0	V	48.2	54.0	-5.8
2440.0	4880.0	H	41.0	54.0	-13.0
2440.0	4880.0	V	40.5	54.0	-13.5
2480.0	4960.0	H	41.5	54.0	-12.5
2480.0	4960.0	V	41.1	54.0	-12.9
2480.0	2483.5	H	53.6	54.0	-0.4
2480.0	2483.5	V	53.0	54.0	-1.0

Figure 34. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

9.5 *Test Instrumentation Used; Emissions in Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Spectrum Analyzer	HP	8593EM	3536A00120ADI	March 10, 2016	March 10, 2017
EMI Receiver	HP	8542E	3906A00276	March 3, 2016	March 3, 2017
RF Filter Section	HP	85420E	3705A00248	March 3, 2016	March 3, 2017
Spectrum Analyzer	HP	8564E	3442A00275	March 10, 2016	March 10, 2017
Biconical Antenna	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Active Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 5, 2016
Log Periodic Antenna	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	September 30, 2016
Low Noise Amplifier Chain	HP + Miteq	AFSX4-02001800-50-8P	-	July 20, 2016	July 20, 2017
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 35 Test Equipment Used

10. Transmitted Power Density

10.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(e)

10.2 *Test Procedure*

(Temperature (22°C)/ Humidity (58%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. . The distance between the E.U.T to the test antenna was 3m.

The configuration tested is shown in *Figure* 2.

The spectrum analyzer was set to 3 kHz RBW and VBW to 10 kHz.

The E.U.T was evaluated in 3 channels: Low (2405MHz), Mid (2440MHz) and High (2480MHz).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \quad [W]$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

10.3 *Test Limit*

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

10.4 *Test Results*

Operation Frequency	Reading Spectrum Analyzer	Reading Spectrum Analyzer	Limit	Margin
(MHz)	(dBµV/m)	(dBm)	(dBm)	(dB)
2405.0	89.3	-5.9	8.0	-13.9
2440.0	88.5	-6.7	8.0	-14.7
2480.0	88.2	-7.0	8.0	-15.0

Figure 36 Test Results

JUDGEMENT: Passed by 13.9dB

For additional information see *Figure 37* to *Figure 39.*

Transmitted Power Density

E.U.T Description	Outdoor Payment Terminal
Model Number	OrPAY1000
Part Number:	1021266

Date: 8.AUG.2016 06:53:01

Figure 37 — Transmitted Power Density - 2405.0 MHz

Date: 8.AUG.2016 07:09:56

Figure 38 — Transmitted Power Density -2440.0 MHz

Transmitted Power Density

E.U.T Description	Outdoor Payment Terminal
Model Number	OrPAY1000
Part Number:	1021266

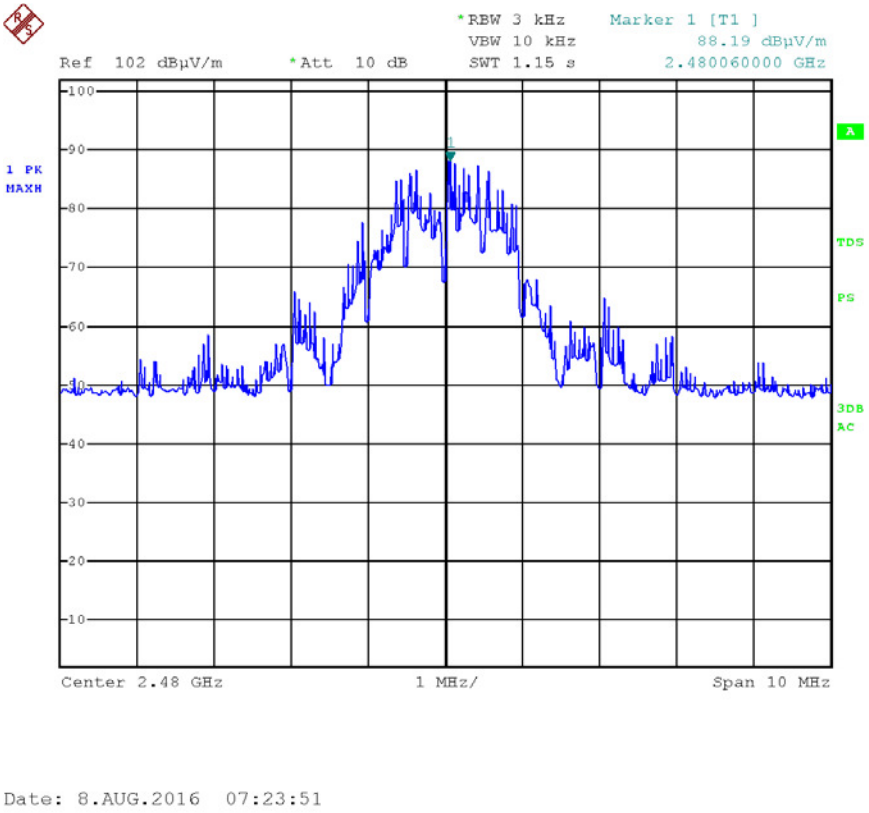

Figure 39 — Transmitted Power Density - 2480.0 MHz

10.5 *Test Equipment Used; Transmitted Power Density*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 40 Test Equipment Used

11. Antenna Gain/Information

TI antenna SWRA117D with an antenna gain of +5.3dB. It is a small size 2.4 GHz PCB antenna.

TI antenna SWRU120B with antenna gain of +3.3 dB. It is a 2.4 GHz Inverted F antenna

12. R.F Exposure/Safety

Typical use of the E.U.T. is as a Point of Sale Terminal

The typical placement of the E.U.T. is in a gas station. The typical distance between the E.U.T. and the user is 0.5 cm.

Section 4.3.1 and Appendix A of KDB447498 D01 V05 was used as the guidance as follows:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] *· [√f(GHz)] =2.75/5 * 1.55= 0.85 this value is less than 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR.

The SAR measurement is not necessary

13. APPENDIX A - CORRECTION FACTORS

13.1 *Correction factors for RF OATS Cable 35m*

ITL #1784

Frequency (MHz)	Cable loss (dB)
10.0	0.3
20.0	0.2
50.0	-0.1
100.0	-0.6
200.0	-1.2
500.0	-2.3
1000.0	-3.6

13.2 *Correction factors for RF OATS Cable 10m ITL #1794*

Frequency(MHz)	Cable loss(dB)
10.0	-0.3
20.0	-0.3
50.0	-0.5
100.0	-0.7
200.0	-1.1
500.0	-1.8
1000.0	-2.7

13.3 *Correction factors for* *Horn Antenna*

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

13.4 *Correction factors for* *Horn ANTENNA*

Model: 3115

Antenna serial number: 29845

3 meter range

f(GHz)	AF(dB/m)	GA(dB)
0.75	25	3
1G	23.5	7
1.5G	26	8
2G	29	7
2.5G	27.5	10
3G	30	10
3.5G	31.5	10
4G	32.5	9.5
4.5G	32.5	10.5
5G	33	10.5
5.5G	35	10.5
6G	36.5	9.5
6.5G	36.5	10
7G	37.5	10
7.5G	37.5	10
8G	37.5	11
8.5G	38	11
9G	37.5	11.5
9.5G	38	11.5
10G	38.5	11.5
10.5G	38.5	12
11G	38.5	12.5
11.5G	38.5	13
12G	38	13.5
12.5G	38.5	13
13G	40	12
13.5G	41	12
14G	40	13
14.5G	39	14
15G	38	15.5
15.5G	37.5	16
16G	37.5	16
16.5G	39	15
17G	40	15
17.5G	42	13.5
18G	42.5	13

13.5 *Correction factors for Log Periodic Antenna EMCO, Model 3146, Serial #9505-4081*

Frequency [MHz]	AF [dB/m]
200.0	11.47
250.0	12.06
300.0	14.77
400.0	15.77
500.0	18.01
600.0	18.84
700.0	20.93
800.0	21.27
900.0	22.44
1000.0	24.10

13.6 *Correction factors for Biconical Antenna EMCO, Model 3110B, Serial #9912-3337*

Frequency [MHz]	AF [dB/m]
30.0	14.18
35.0	13.95
40.0	12.84
45.0	11.23
50.0	11.10
60.0	10.39
70.0	9.34
80.0	9.02
90.0	9.31
100.0	8.95
120.0	11.53
140.0	12.20
160.0	12.56
180.0	13.49
200.0	15.27

13.7 *Correction factors for ACTIVE LOOP ANTENNA*

Model 6502
S/N 9506-2950

f(MHz)	MAF(dBs/m)	AF(dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40	11.5
3	-40	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11
10	-40.5	11
20	-41.5	10
30	-43.5	8