

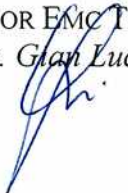

 CE MARKING ELECTROMAGNETIC COMPATIBILITY ELECTRICAL SAFETY LASER SPECTROSCOPY ENVIRONMENTAL PHYSIC		 
G.S.D. S.r.l PISA - Italy		Test Report n. 14450
		Rev. 01
Manufacturer	TERTIUM Technology S.r.l.	
Address	Via G. B. Picotti, 8 56124 Pisa Italy	
Test Family Name	MWS Reader	
Frequency Range / RF	2405-2480 MHz	
Testing Laboratory Name	G.S.D. S.r.l.	
Address	Via Marmiceto, 8 56121 Ospedaletto Pisa (PI) Italy	
Tel/Fax	+39 050 984254 / +39 050 984262	
P.IVA/VAT	01343950505	
http – e-mail	www.gsd.it - info@gsd.it	
	FCC Listed: Registration Number: 424037 IC Listed: Registration Number: 9353A	
Location and Date of Issue	Pisa, 2014 November 11	
<p style="text-align: center;">G.S.D. s.r.l. Via Marmiceto, 8 56121 OSPEDALETTO - PISA Tel. 050.984254 - Fax 050.984262 P. IVA 01343950505</p> <div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <p>SENIOR EMC TEST MANAGER Dr. Gian Luca Genovesi</p>  </div> <div style="text-align: center;"> <p>QUALITY MANAGER Dr. David Pelliccia</p>  </div> </div>		

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1. MANUFACTURER AND EUT IDENTIFICATION¹	
Manufacturer	TERTIUM Technology S.r.l.
Address	Via G. B. Picotti, 8 56124 Pisa Italy
Test Family Name	MWS Reader
Date of reception	2014 August 07
Sampling	Laboratory sample for certification
Test Item Description	WiFi Device
Nominal Input Voltage	12 Vdc
Software	
FCC ID	Y6D-MWSAR010

¹A detailed documentation is preserved in the internal fascicle.



*Fig. 1.1
Equipment Under Test - Photo*

2. REFERENCE STANDARDS

Tests and measurements are performed accordingly to the reference standards given in the table below:

<i>TEST</i>	<i>STANDARD</i>
Operation within the band 2400-2483,5 MHz: Test Procedures 15.247 (a)(2), (b)(3), (d), (e)	FCC Rules and Regulations, Title 47 Part 15 – Sub part B ANSI C63.4 (2009) – American National Standard for Methods of Measuring of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz – 40 GHz FCC KDB 558074 D01 DTS Meas Guidance v03r02
Maximum Permissible Exposure	OET Bulletin 65 Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields FCC Rules and Regulations, Title 47 (2008) Part 15 – Sub part B

3. RESULT, CONDITION, MEASUREMENT UNCERTAINTYSummary of Test Results

<i>TEST</i>	<i>RESULT</i>
6 dB bandwidth Section 15.247 (a) (2) KDB 558074 §8 Option 1	Pass
Peak Conducted Output Power: Section 15.247 (b) (3) KDB 558074 §9.1.1	Pass
Band Edge Section 15.247 (d) KDB 558074 §13.3.1	Pass
Power Spectral Density Section 15.247 (e) KDB 558074 §10.1	Pass
Radiated Emissions Section 15.209 KDB 558074 §12	Pass

Internal Procedures:

APR01: internal procedure for antenna port measurement Revision 01

CE22R01: internal procedure for power lead port measurement Revision 01

RE22R02: internal procedure for radiated emissions measurement Revision 02

Measurement uncertainty

<i>TEST</i>	<i>EXPANDED UNCERTAINTY</i>
Conducted Emission – 50Ω/50μH AMN (150 kHz - 30 MHz)	± 3.5 dB
Radiated Emission – (Semianechoic Room) (30 MHz - 40 GHz)	± 4.7 dB

Climatic Conditions

<i>PARAMETER</i>	<i>VALUE</i>
Temperature	(293 ± 3) K
Relative humidity	(50 ± 5) %

Power during the tests: Internal battery

Extensions

The results refer only to the sampled EUT and under the specified conditions.

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4. 6 dB BANDWIDTH

Peak Output Power

Equipment shall meet the limits below .

<i>FREQUENCY RANGE</i> (MHz)	Limit
2400 2483,5	The minimum 6 dB Bandwidth shall be at least 500 kHz

Results: 6dB Bandwidth > 500 kHz

<i>Channel</i>	<i>Frequency</i> (MHz)	<i>6 dB Bandwidth</i> (MHz)	<i>Minimum Limit</i> (MHz)	<i>Margin</i> (MHz)
Low	2405	1,515	0,5	1,02
Mid	2440	1,656	0,5	1,16
High	2480	1,654	0,5	1,15

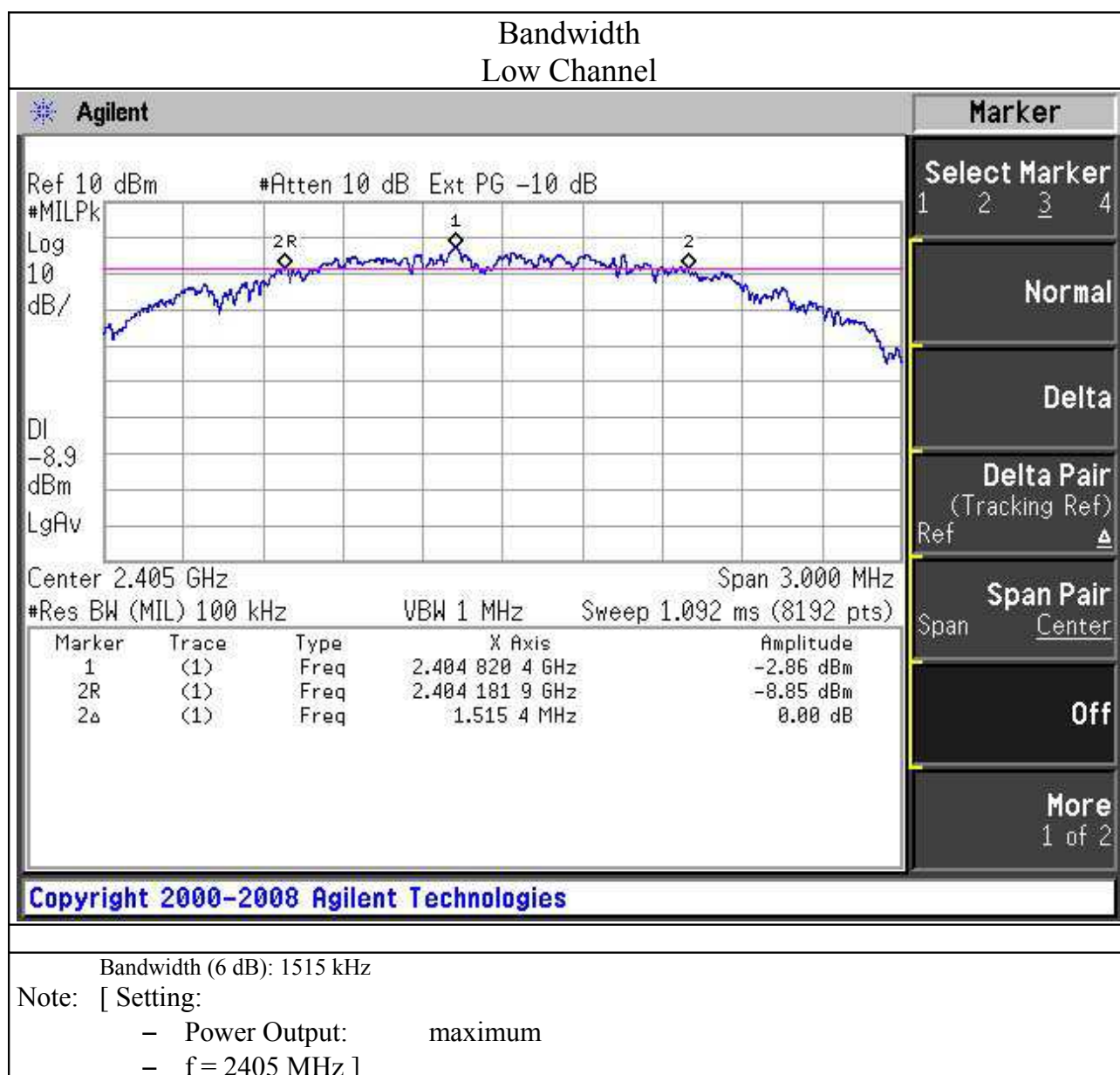
Test Equipment

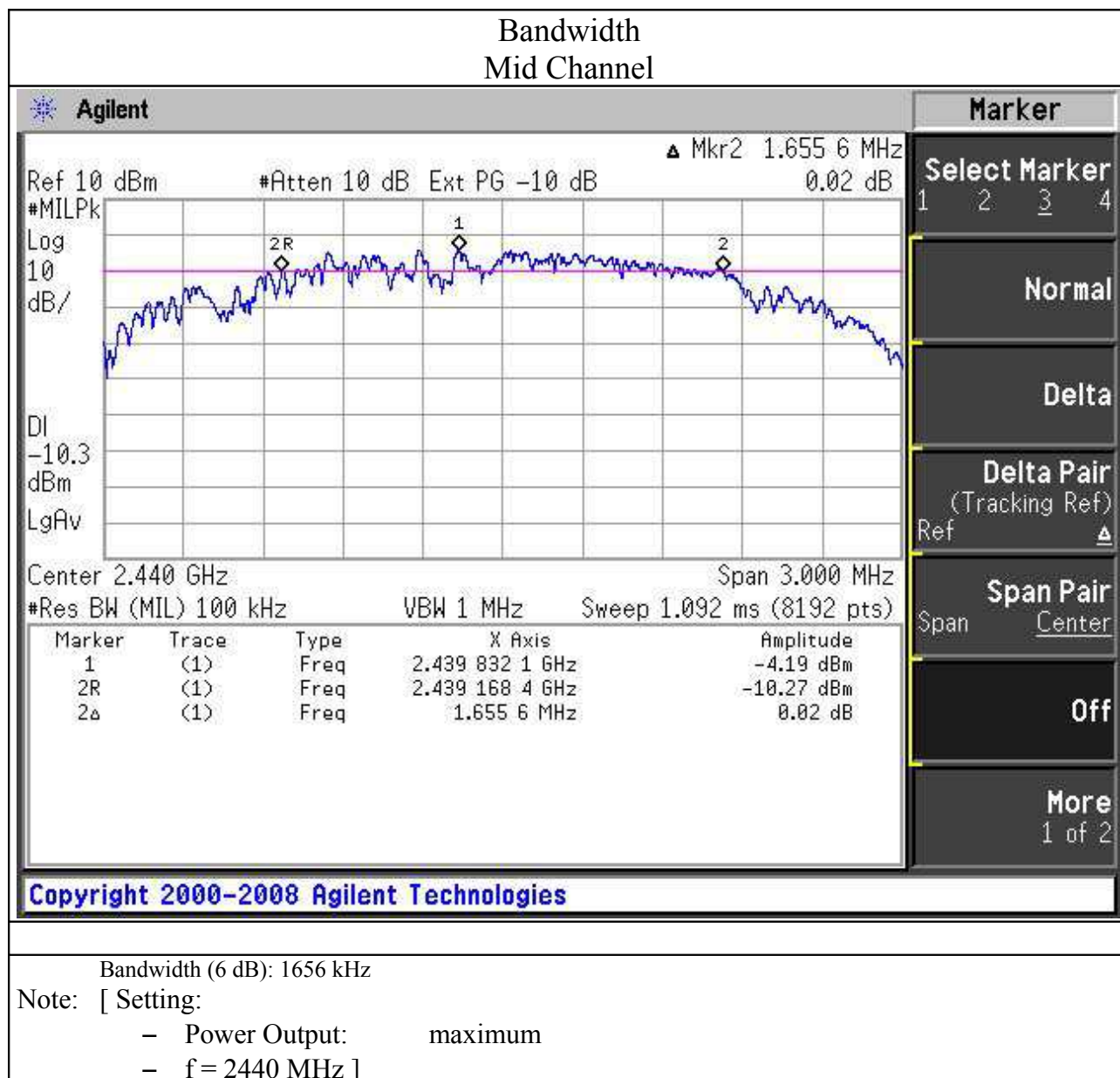
EQUIPMENT	MANUFACTURER	MODEL	CAL. DATE
EMI Receiver	Agilent	E4440A	01/2015

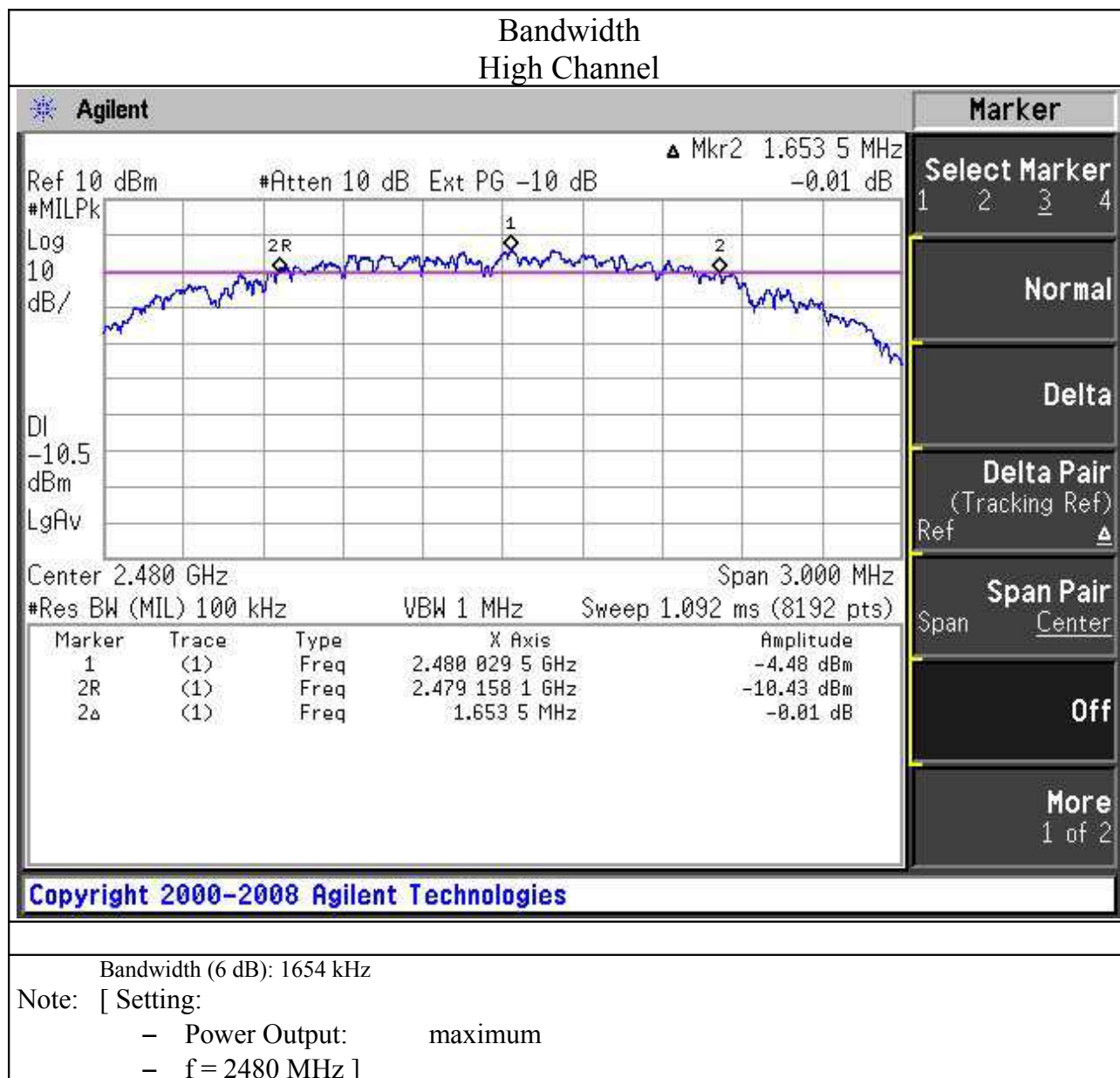
Test procedure: APR01

Test performed on low, middle and high channels.

In the following graphs results are shown:







5. MAXIMUM PEAK OUTPUT POWER

Equipment shall meet the limits below .

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt (+30 dBm).

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DATE
EMI Receiver	Agilent	E4440A	01/2015

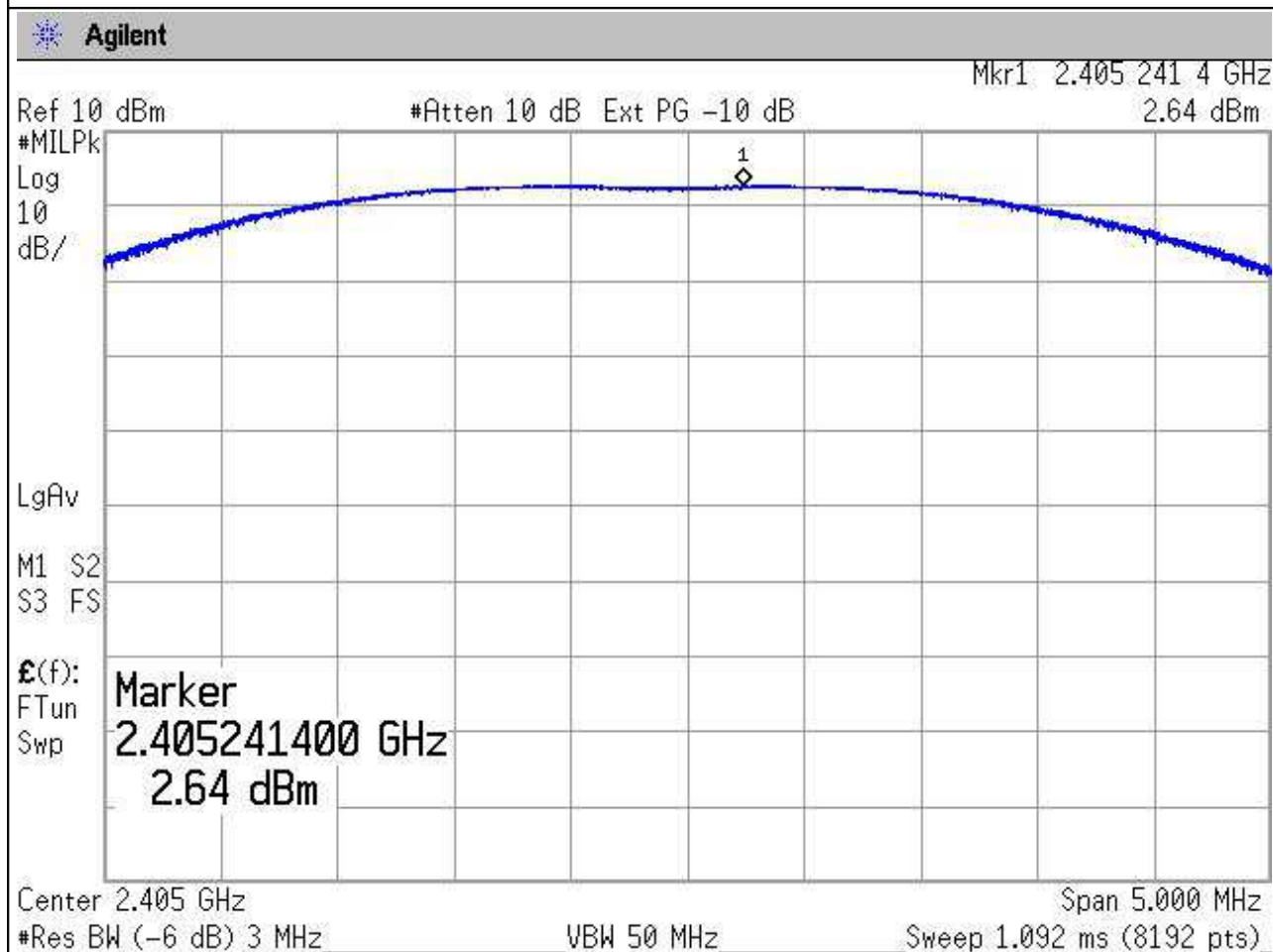
Test procedure: APR01

Results:

No non-compliance noted

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2405	2,63	30	-27,37
Mid	2440	2,46	30	-27,54
High	2480	2,17	30	-27,83

Maximum Peak Conducted Output Power Low Channel



Note: [Setting:
- Power Output: maximum
- f = 2405 MHz]

Maximum Peak Conducted Output Power Mid Channel



Note: [Setting:

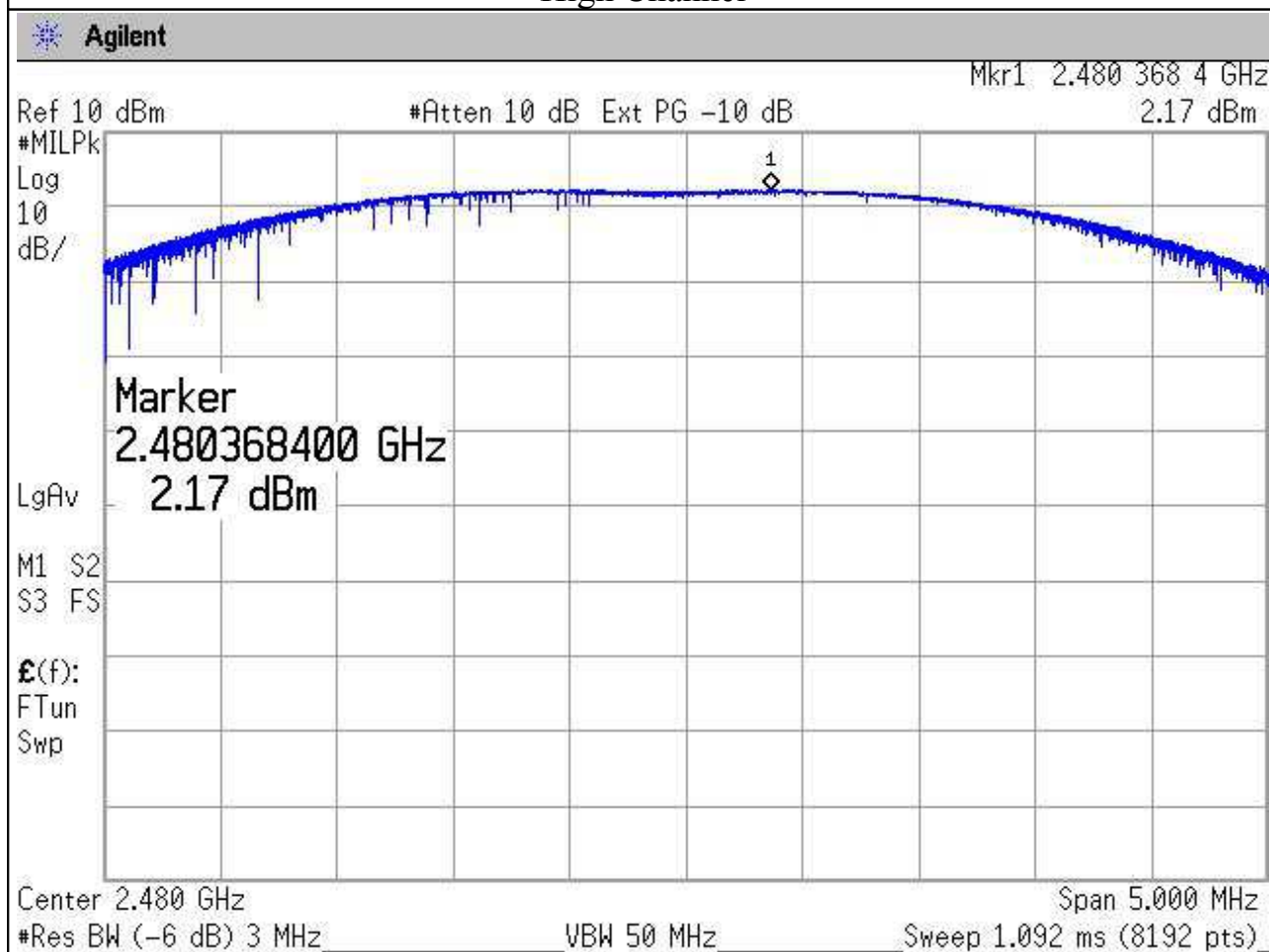
- Power Output: maximum
- f = 2440 MHz]

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Maximum Peak Conducted Output Power High Channel



Note: [Setting:

- Power Output: maximum
- f = 2480 MHz]

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6. BAND EDGE AND CONDUCTED SPURIOUS EMISSIONS

Equipment shall meet the limits below .

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, based on either an RF conducted or a radiated measurement.

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DATE
EMI Receiver	Agilent	E4440A	01/2015

Test procedure: APR01

Test performed on low, middle and high channels.

Results:

No non-compliance noted

The following figures show the results.

Band-Edge Conducted Low Channel



Agilent

R T

Ref 10 dBm

Atten 10 dB Ext PG -11 dB

▲ Mkr3 2.845 MHz
0.09 dB

Peak
Log
10
dB/

DI
-31.2
dBm
LgAv

M1 S2

Center 2.405 000 GHz

Span 50 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 4.915 ms (8192 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.404 838 GHz	-1.23 dBm
2R	(1)	Freq	2.402 287 GHz	-31.21 dBm
2Δ	(1)	Freq	5.311 MHz	-0.20 dB
3R	(1)	Freq	2.403 519 GHz	-21.43 dBm
3Δ	(1)	Freq	2.845 MHz	0.09 dB

Note: [Setting:

- Power Output: maximum
- f = 2405 MHz]

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Band-Edge Conducted High Channel



Agilent

R T

Ref 10 dBm

Atten 10 dB Ext PG -11 dB

▲ Mkr3 2.790 MHz
-0.02 dB

Peak
Log
10
dB/

DI
-32.2
dBm
LgAv

M1 S2

Center 2.480 00 GHz

Span 50 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 4.915 ms (8192 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 857 GHz	-2.18 dBm
2R	(1)	Freq	2.477 281 GHz	-32.32 dBm
2Δ	(1)	Freq	5.298 MHz	-0.06 dB
3R	(1)	Freq	2.478 550 GHz	-22.19 dBm
3Δ	(1)	Freq	2.790 MHz	-0.02 dB

Note: [Setting:

- Power Output: maximum
- f = 2480 MHz]

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7. PEAK POWER SPECTRAL DENSITY

Equipment shall meet the limits below .

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.

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DATE
EMI Receiver	Agilent	E4440A	01/2015

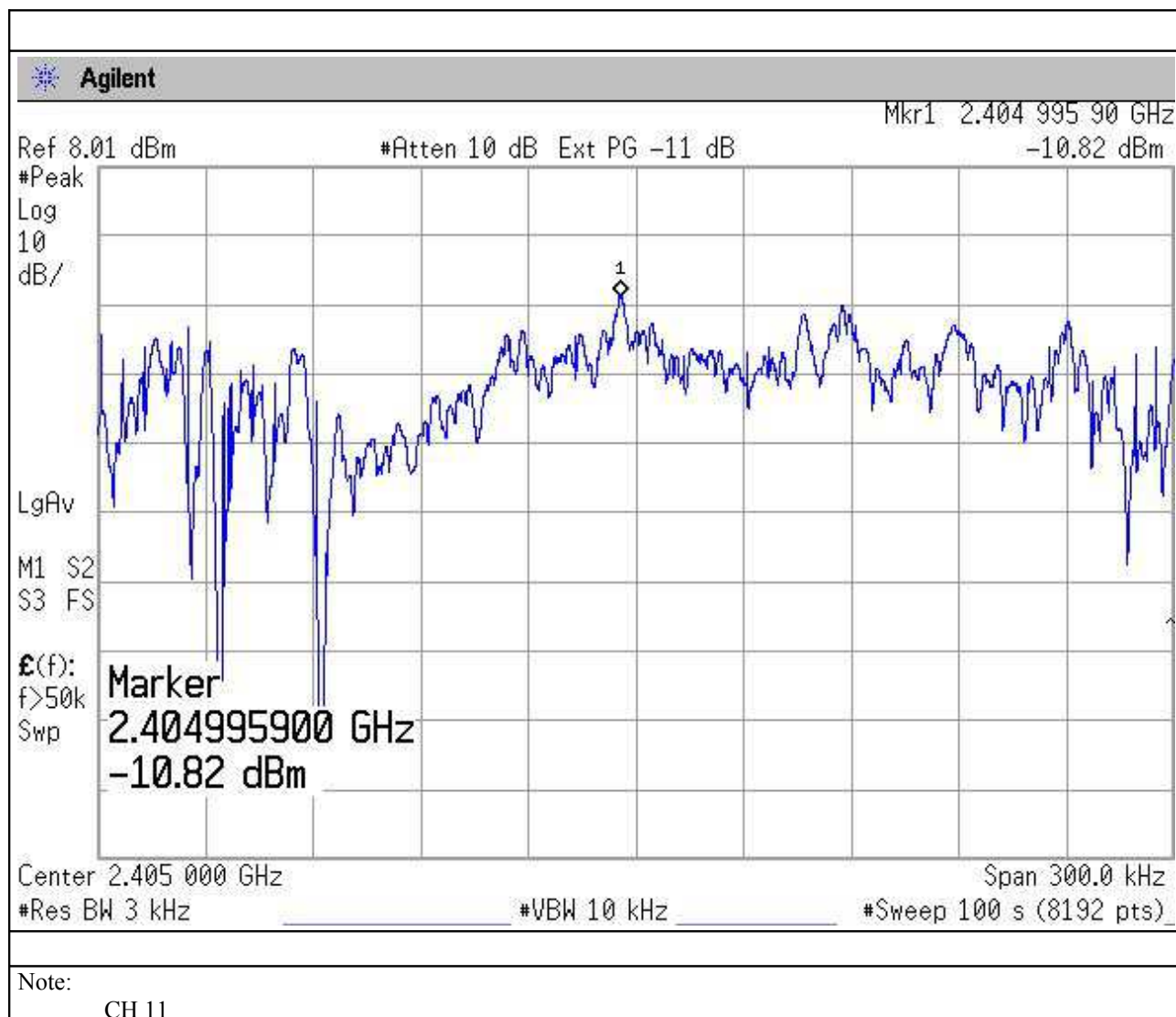
Test procedure: APR01

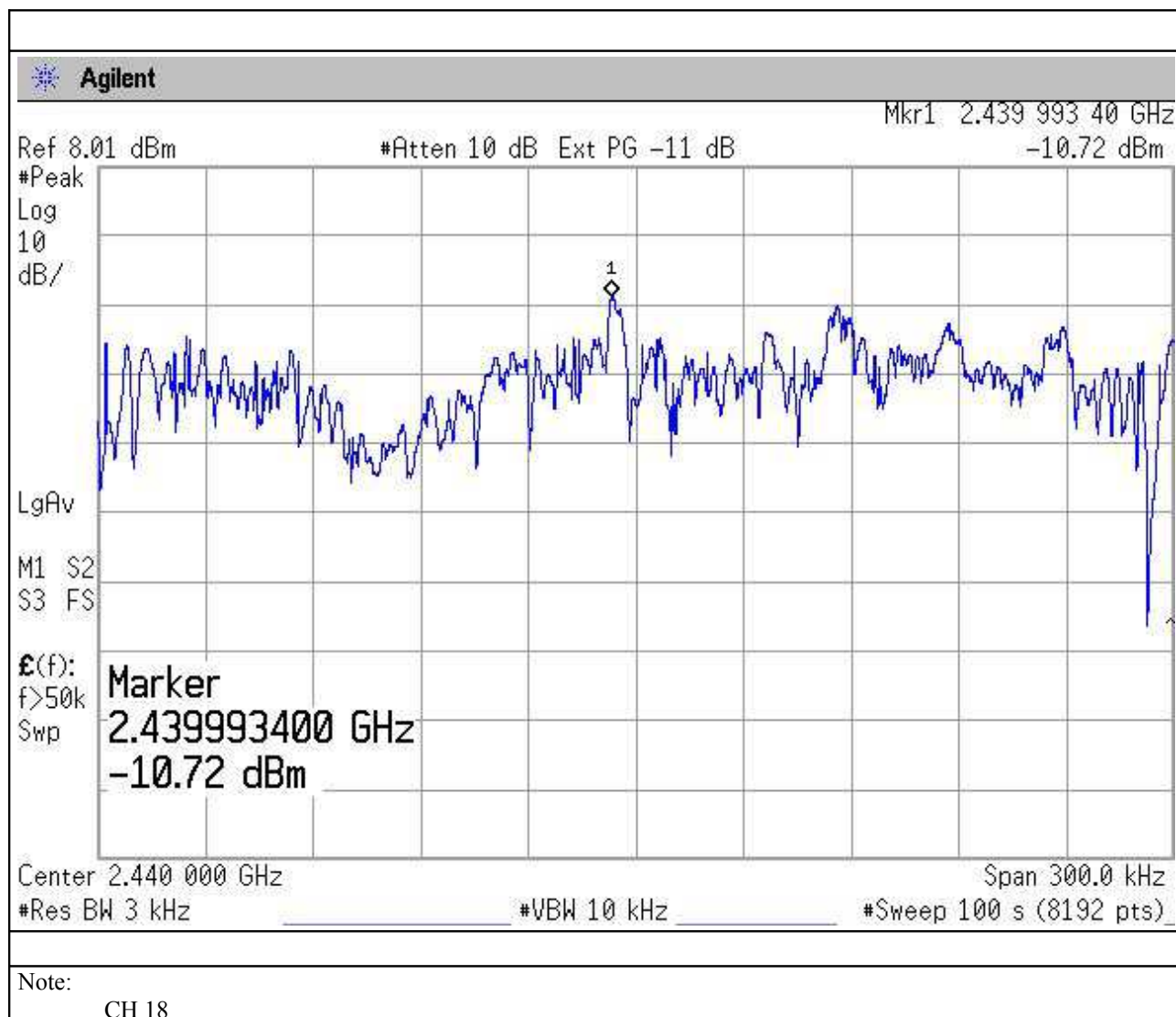
Test performed on low, middle and high channels and in the b,g,n protocols at maximum and minimum data rate for each protocol.

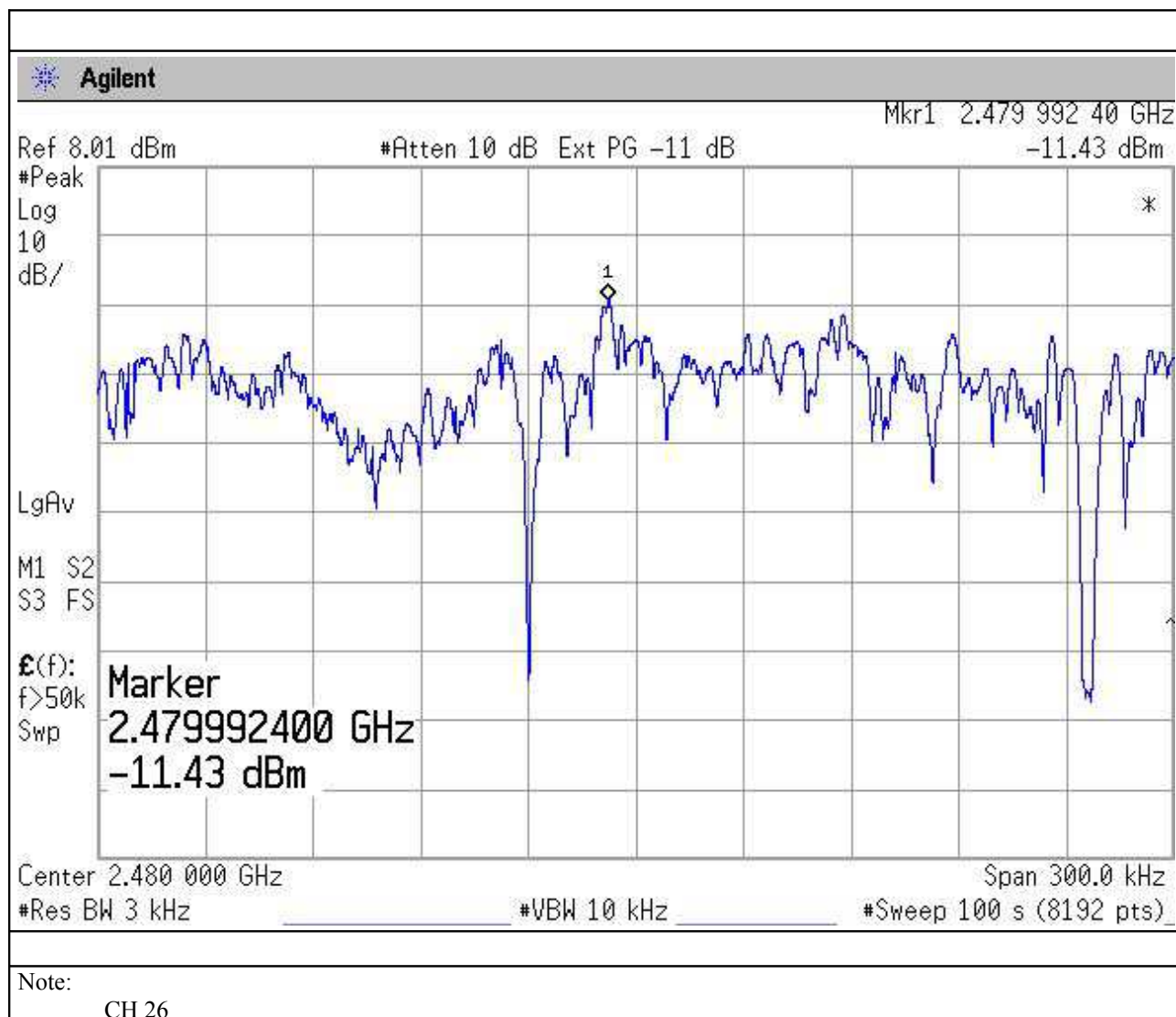
Results:

No non-compliance noted

<i>Channel</i>	<i>Frequency (MHz)</i>	<i>PPSD (dBm)</i>	<i>Limit (dBm)</i>	<i>Margin (dB)</i>
Low	2405	-10,82	8	-18,82
Mid	2440	-10,72	8	-18,72
High	2480	-11,43	8	-19,43
The following figures show the results.				







8. RADIATED EMISSIONS

In the following table you can find the limits established by the reference standard:

FCC

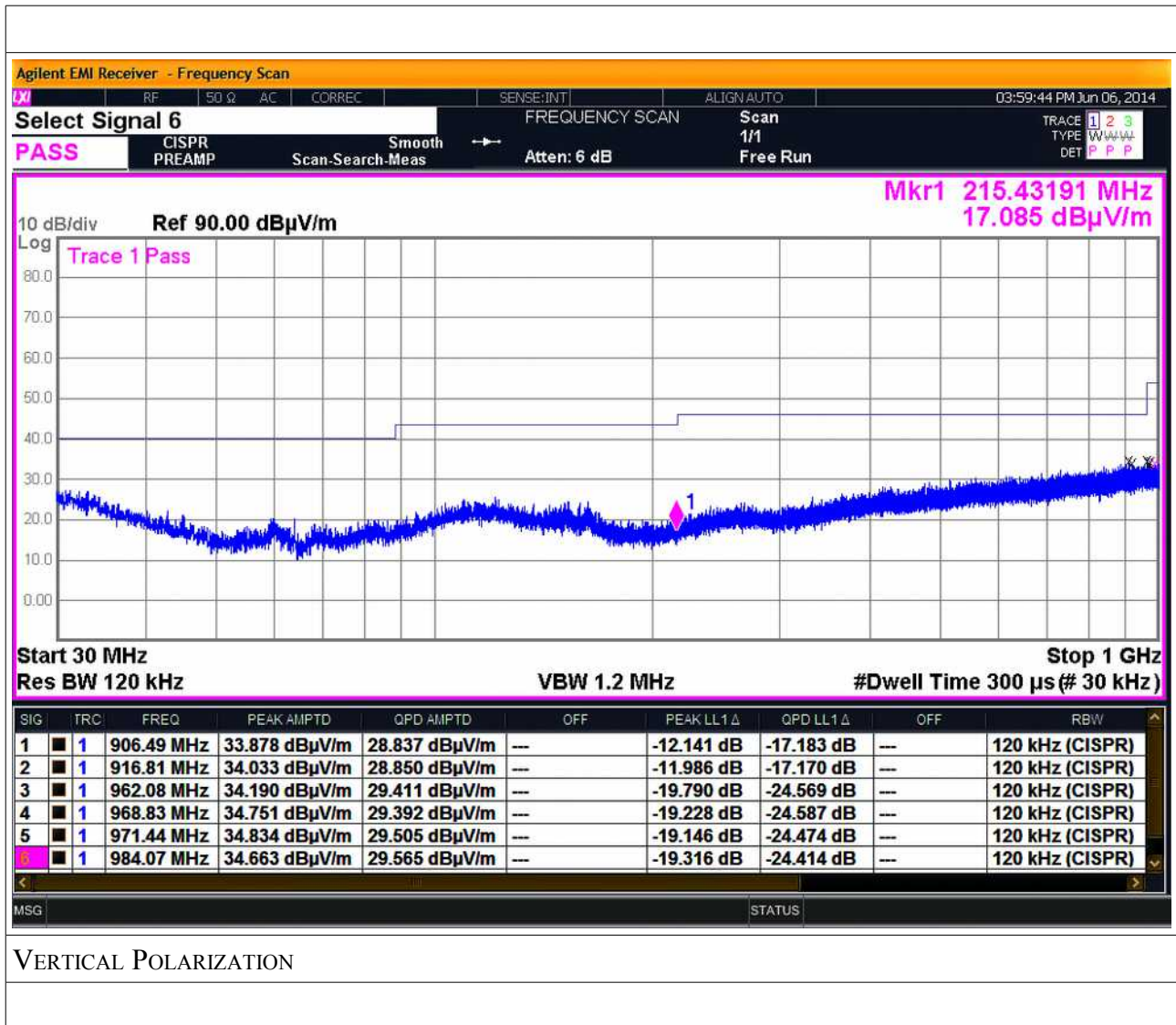
<i>DISTANCE</i> (m)	<i>FREQUENCY RANGE</i> (MHz)	<i>QUASI-PEAK LIMITS</i> [dB (μV/m)]	<i>AVERAGE LIMITS</i> [dB (μV/m)]
300	0,009 – 0,49	48,52 – 13,8	
30	0,049 – 1,705	33,8 – 22,97	
30	1,705 - 30	29,54	
3	30 – 88	40	--
3	88 – 216	43,5	--
3	216 – 960	46	--
3	960 – 1000	54	--
3	Above 1000	--	54

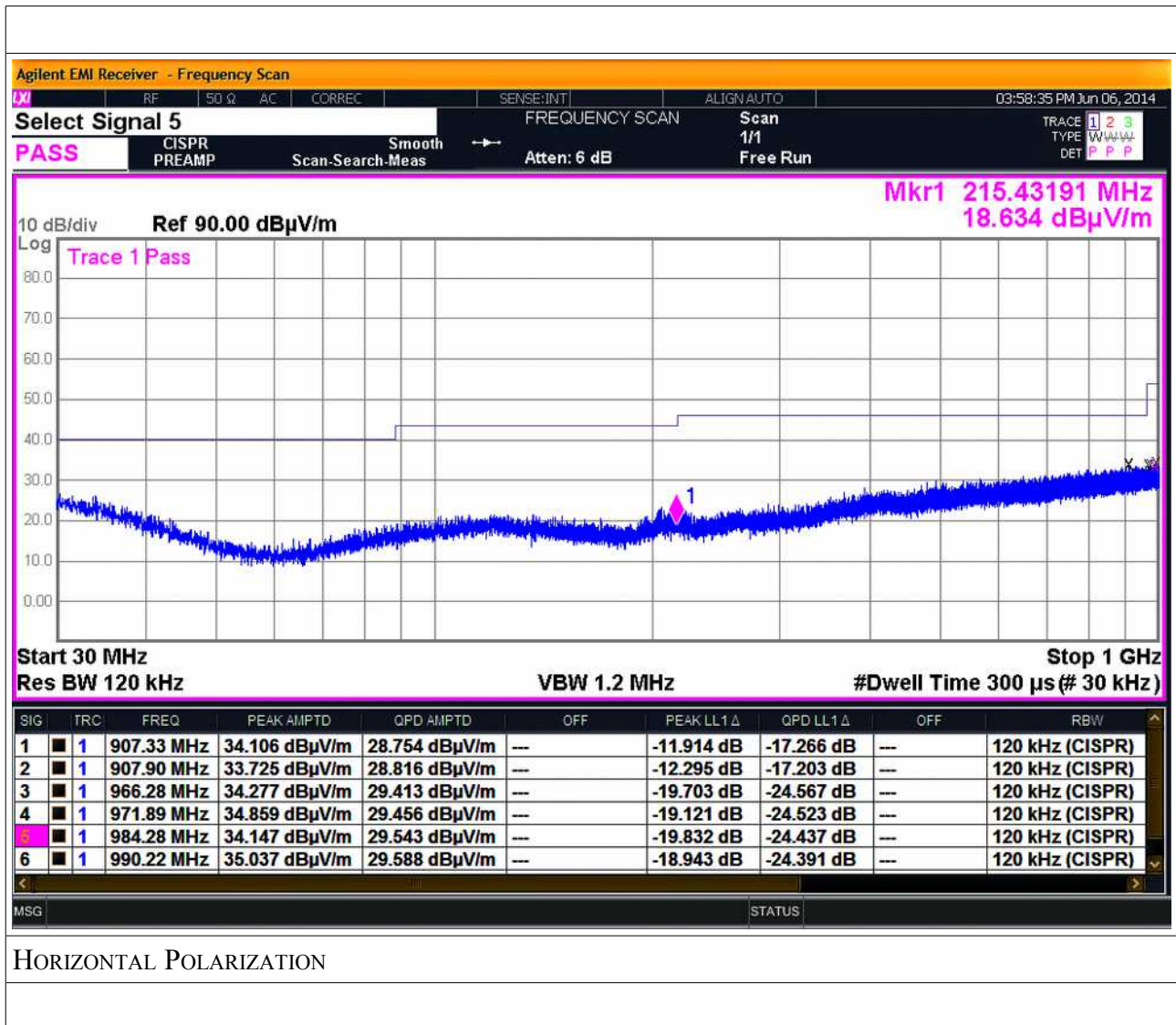
Test Equipment

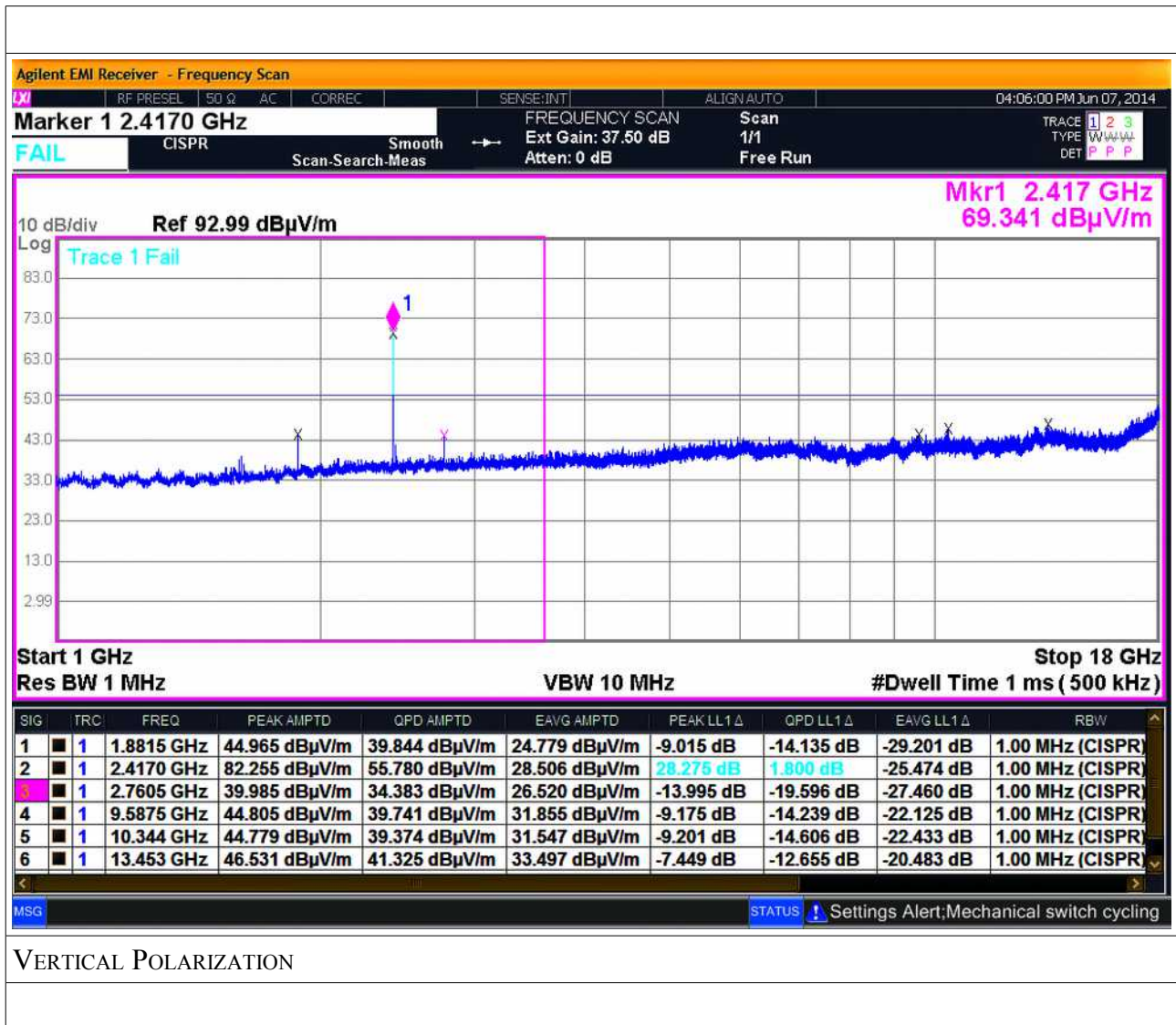
EQUIPMENT	MANUFACTURER	MODEL	CAL. DATE
EMI Receiver	HP	HP8546A	01/2015
EMI Receiver Filter Section	HP	HP85460A	01/2015
EMI Receiver	Agilent	E4440A	01/2015
EMI Receiver Filter Section	Agilent	N9039A	01/2015
Anechoic Chamber	Comtest	CSA01	01/2015
Horn Antenna (1-18 GHz)	EMCO	3115	01/2015
Loop Antenna	EMCO	6512	01/2015
Horn Antenna (18-26.5 GHz)	Alpha Ind. Inc.	100655A	01/2015
Bilog Antenna	Schaffner	CBL6112B	01/2015
Controller	Deisel	HD100	01/2015
Turn Table	Deisel	MA240	01/2015

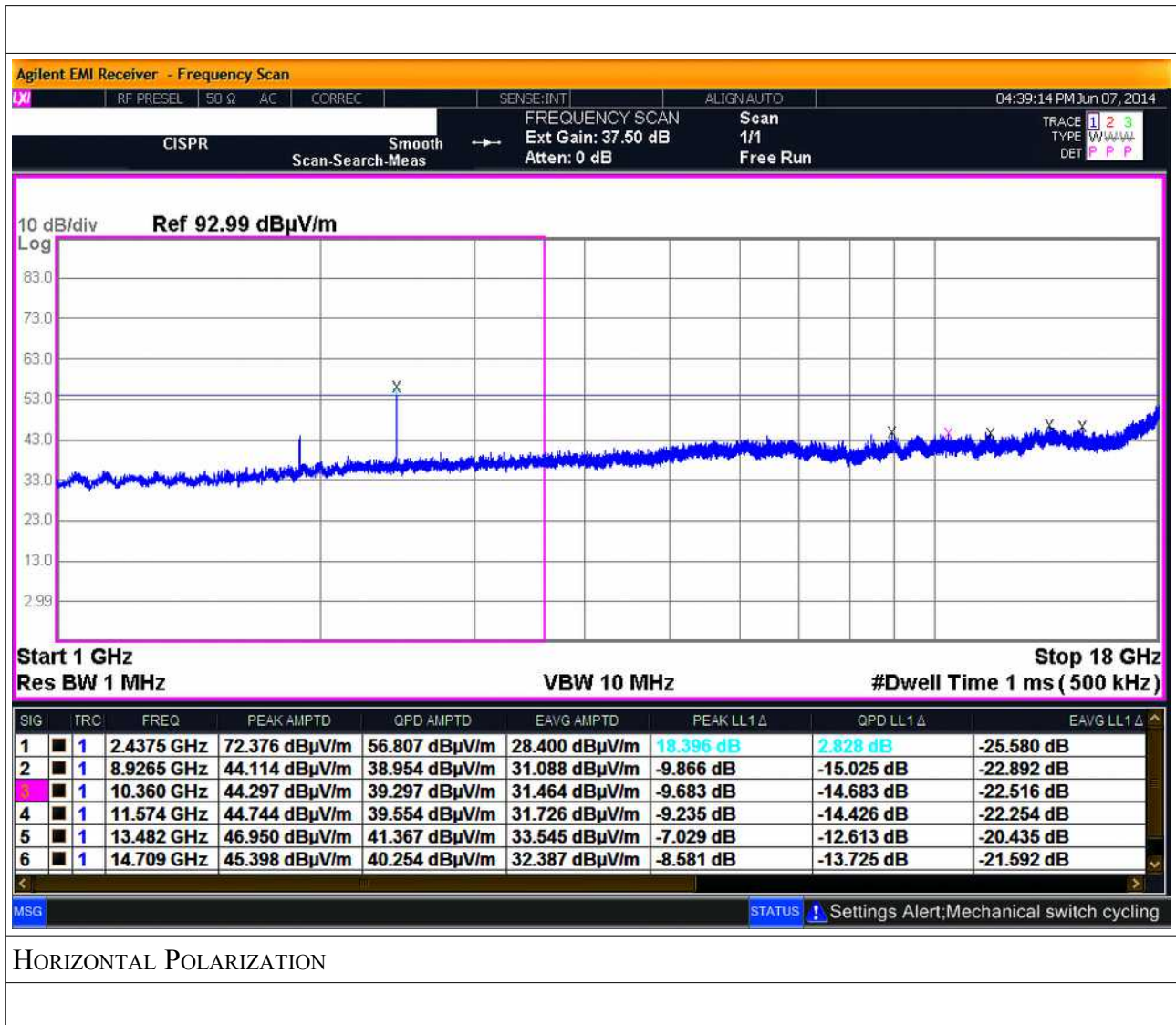
Test procedure: RE22R02

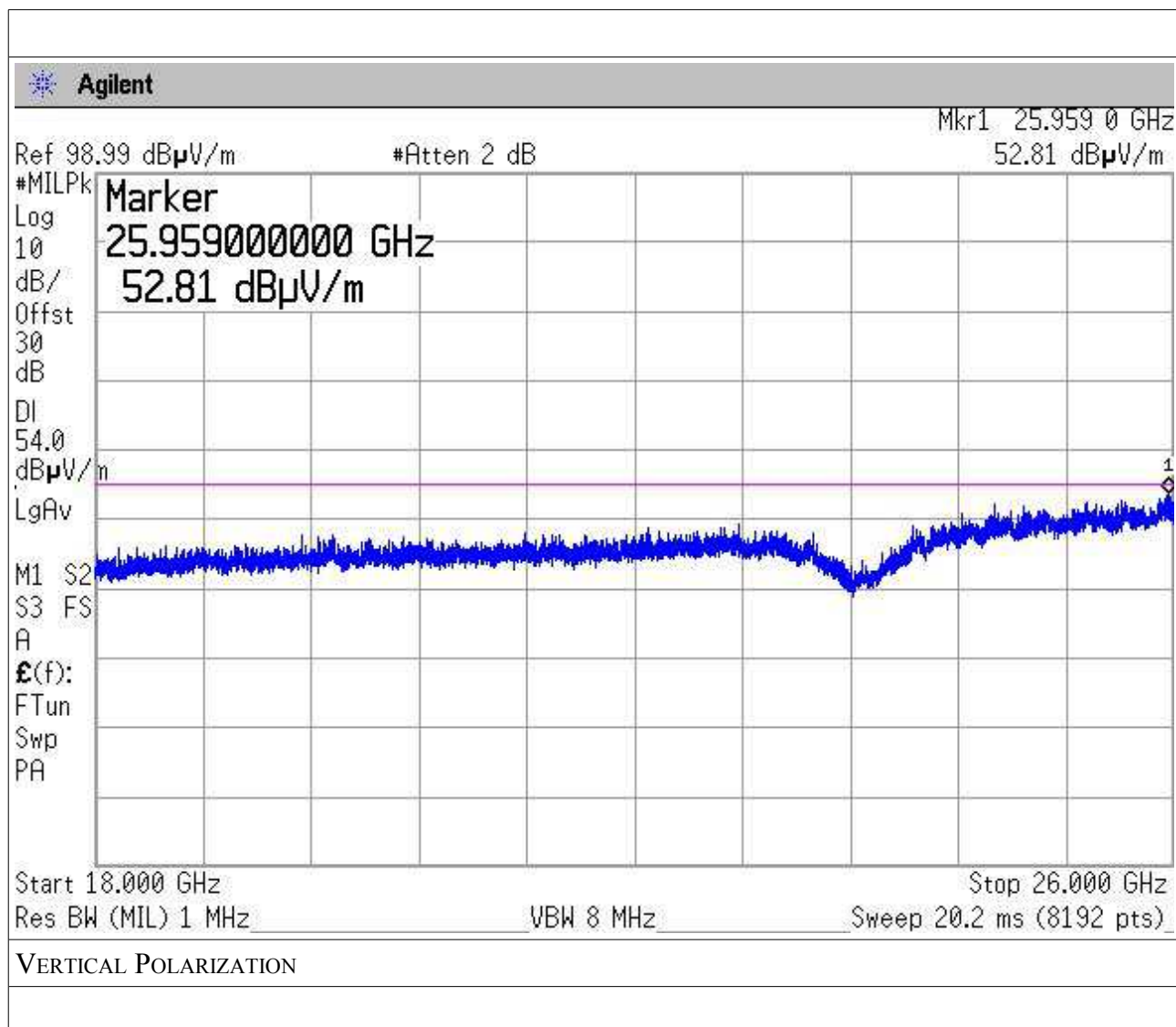
<u>Notes</u>
Azimuth position EUT-Antenna corresponding to 0° identifies the rotating table orientation (TT) in which the instrument to be tested shows the front part turned towards the antenna. Positive grades individuate clockwise rotations of TT when this one is observed from the top. For negative degrees, TT rotation is anticlockwise.
Antenna height respect to the mass plane is conventionally individuated with: MA=XXX where XXX indicates the height (always positive for e>100) expressed in cm.
Antenna horizontal polarisation is indicated by POL=H.
Antenna vertical polarisation is indicated by POL=V.
Accordingly to reference standard, a limit relaxing factor equal to 20 dB for decade for measurements performed at 3 m has been used.
<u>Results and conclusions</u>
In all the operative conditions, equipment complied with the standard limits. Graphics in following figures show the most significant registrations of the performed measurements.

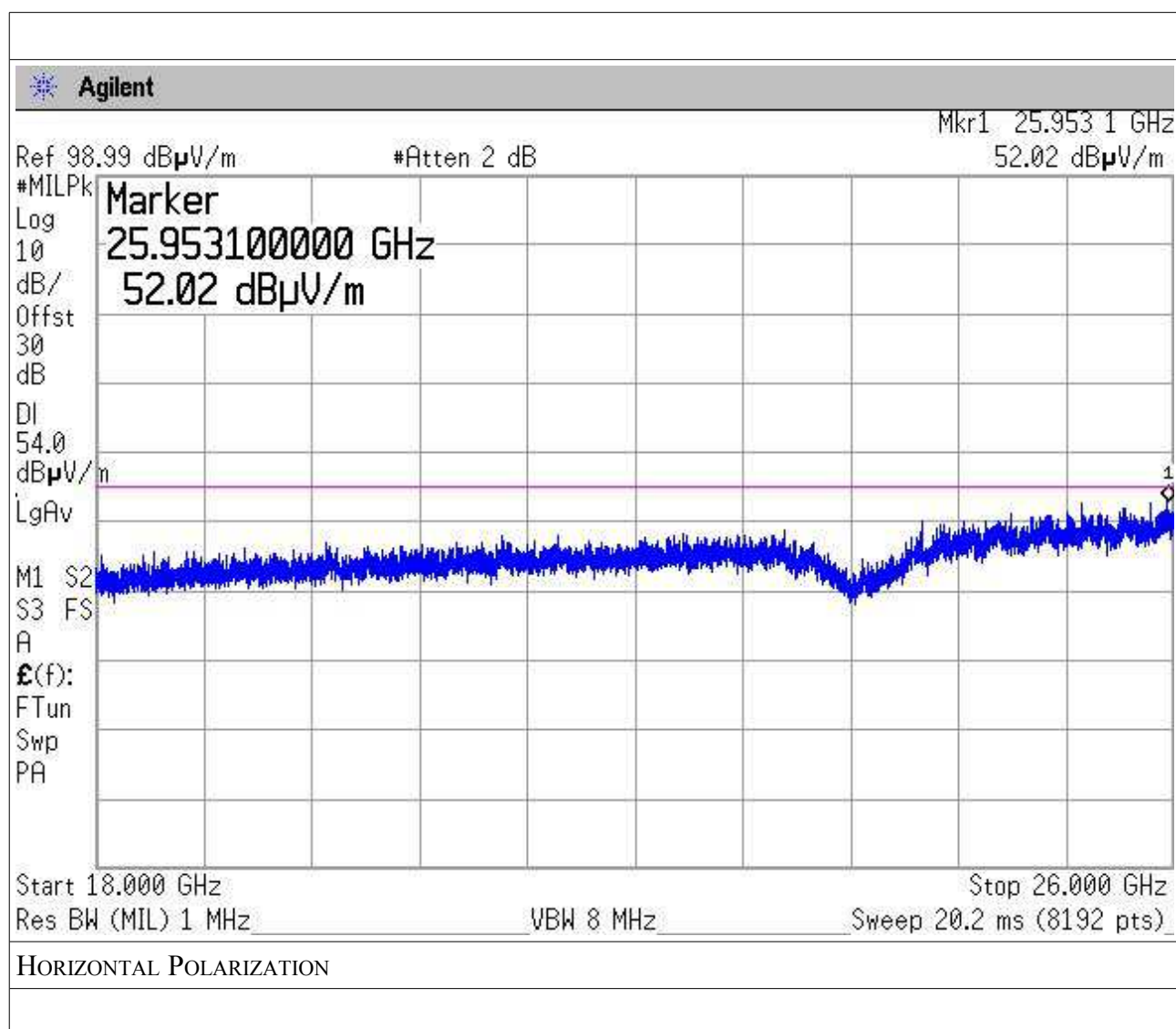


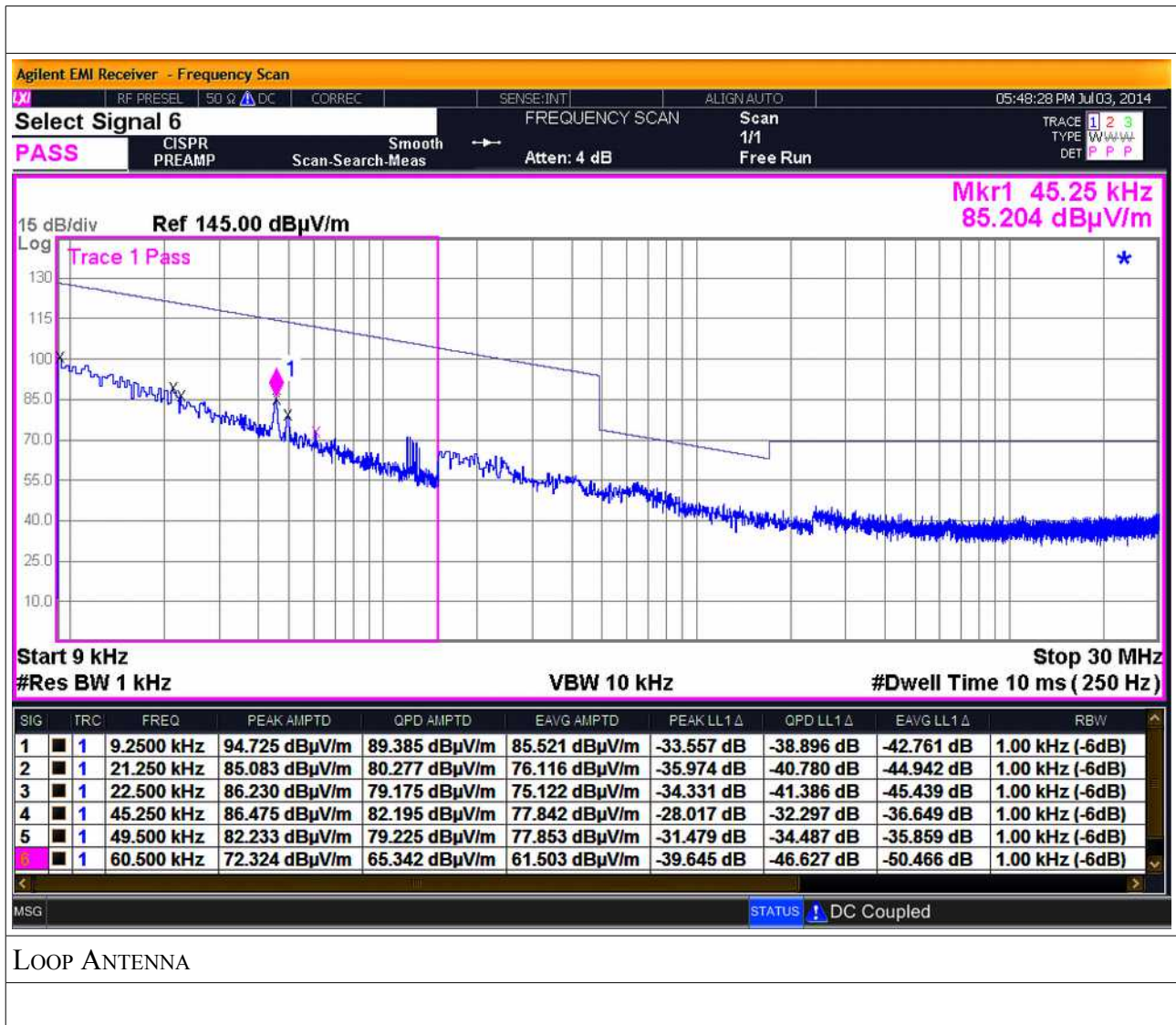












RADIATED SPURIOUS EMISSIONS					
Low Channel					
F GHz	Polarization	Peak dBuV/m	Avg dBuV/m	Limit Peak	Limit Avg
4,824	H	-	-	74,0	54,0
4,824	V	-	-	74,0	54,0
7,236	H	-	-	74,0	54,0
7,236	V	-	-	74,0	54,0
9,648	H	-	-	74,0	54,0
9,648	V	-	-	74,0	54,0
NO OTHER EMISSIONS WERE DETECTED ABOVE SYSTEM NOISE FLOOR					

9. MAXIMUM PERMISSIBLE EXPOSURE

Equipment shall meet the limits below .

1mW/cm² max at 20 cm of distance

Calculation:

$$E = \frac{\sqrt{30 \cdot P \cdot G}}{d}$$

$$S = \frac{(E)^2}{3770}$$

E= Field Strength in Volts/meter

P=Power in watt

G= Numeric Antenna Gain

d= Distance in meter

S= power Density in milliwatts/square centimeter

Arranging terms to calculate the power density at a specific distance yields:

$$S = \frac{0.0795 \cdot 10^{\frac{P+G}{10}}}{d^2}$$

$$S = 0.0795 \cdot 10^{((P+G)/10)} / (d^2)$$

The power density in units of mW/cm² is converted to units of W/m² multiplying by a factor of 10.

Result

Power Density Limit mW/cm ²	Output Power (erp) mW	Power Density at 20cm mW/cm ²	Remark
1	43	0,027	-
(*) OET Bulletin 65			

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10. PHOTO



Fig. 10.1

Radiated Emissions Test Set-up



Fig. 10.2

Radiated Emissions Test Set-up