Laboratories GSD SRL

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ELECTRICAL SAFETY
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Company with Management System certified
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SINCERT

G.S.D. S.r.l PISA - Italy	***Test Report n. 14451***	Rev. 02
Manufacturer	**TERTIUM Technology S.r.l.**	
Address	Via G. B. Picotti, 8 56124 Pisa Italy	
Test Family Name	**MWS Tag**	
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, 2015 January 30	

G.S.D. s.r.l.
Via Marmiceto, 8
56121 OSPEDALETTO - PISA
Tel. 050.984254 - Fax 050.984262
P. IVA 01343950505

SENIOR EMC TEST MANAGER
Dr. Gian Luca Genovesi

QUALITY MANAGER
Dr. David Pelliccia

INDEX

1. MANUFACTURER AND EUT IDENTIFICATION[1]

Manufacturer	**TERTIUM Technology S.r.l..**
Address	Via G. B. Picotti, 8 56124 Pisa Italy
Test Family Name	**MWS Tag**
Date of reception	**2014 August 07**
Sampling	**Laboratory sample for certification**
Test Item Description	**WiFi Device**
Nominal Input Voltage	**3 Vdc**
Antenna Gain	1.6 dBi
FCC ID	Y6D-MWSAT010

[1]A 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:

TEST	***STANDARD***
Operation within the band 2400-2483,5 MHz: Test Procedures 15.247 (a)(2), (b)(3), (d), (e)	FCC Rules ad 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 ad Regulations, Title 47 Part 15 – Sub part B

3. RESULT, CONDITION, MEASUREMENT UNCERTAINTY

Summary of Test Results

TEST	*RESULT*
6 dB bandwidht *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

TEST	*EXPANDED UNCERTAINTY*
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

PARAMETER	*VALUE*
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.

4. 6 dB BANDWIDTH

Peak Output Power

Equipment shall meet the limits below .

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

Results: 6dB Bandwidth > 500 kHz

Channel	*Frequency (MHz)*	*6 dB Bandwidth (MHz)*	*Minimum Limit (MHz)*	*Margin (MHz)*
Low	2405	1,71	0,5	1,21
Mid	2440	1,54	0,5	1,04
High	2480	1,53	0,5	1,03

Test Equipment

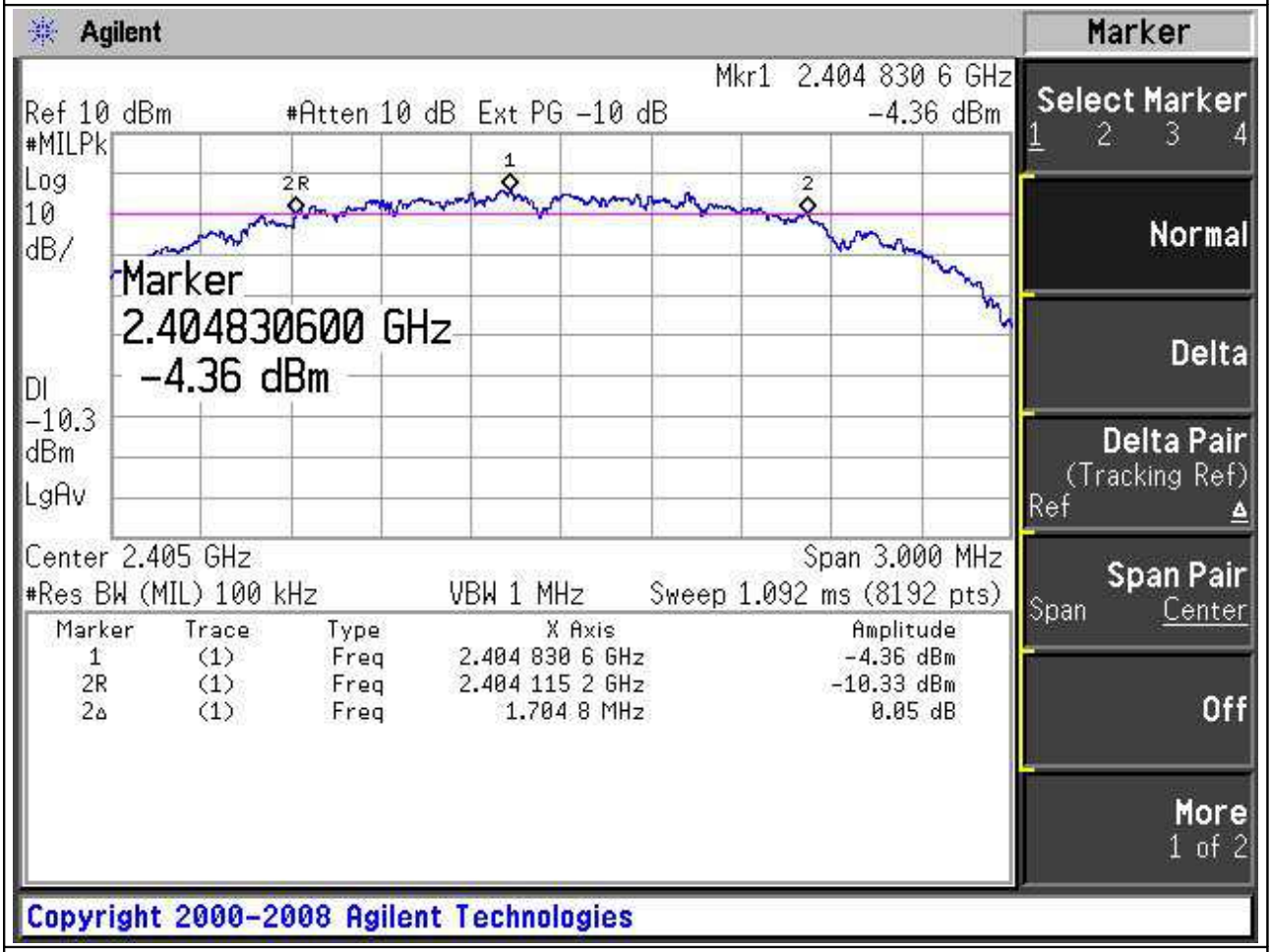
EQUIPMENT	MANUFACTURER	MODEL	CAL. DATE
EMI Receiver	Agilent	E4440A	01/2015

Test procedure: APR01

Test performed on low, middle and high channels.

In the following graphs results are shown:

Bandwidth
Low Channel

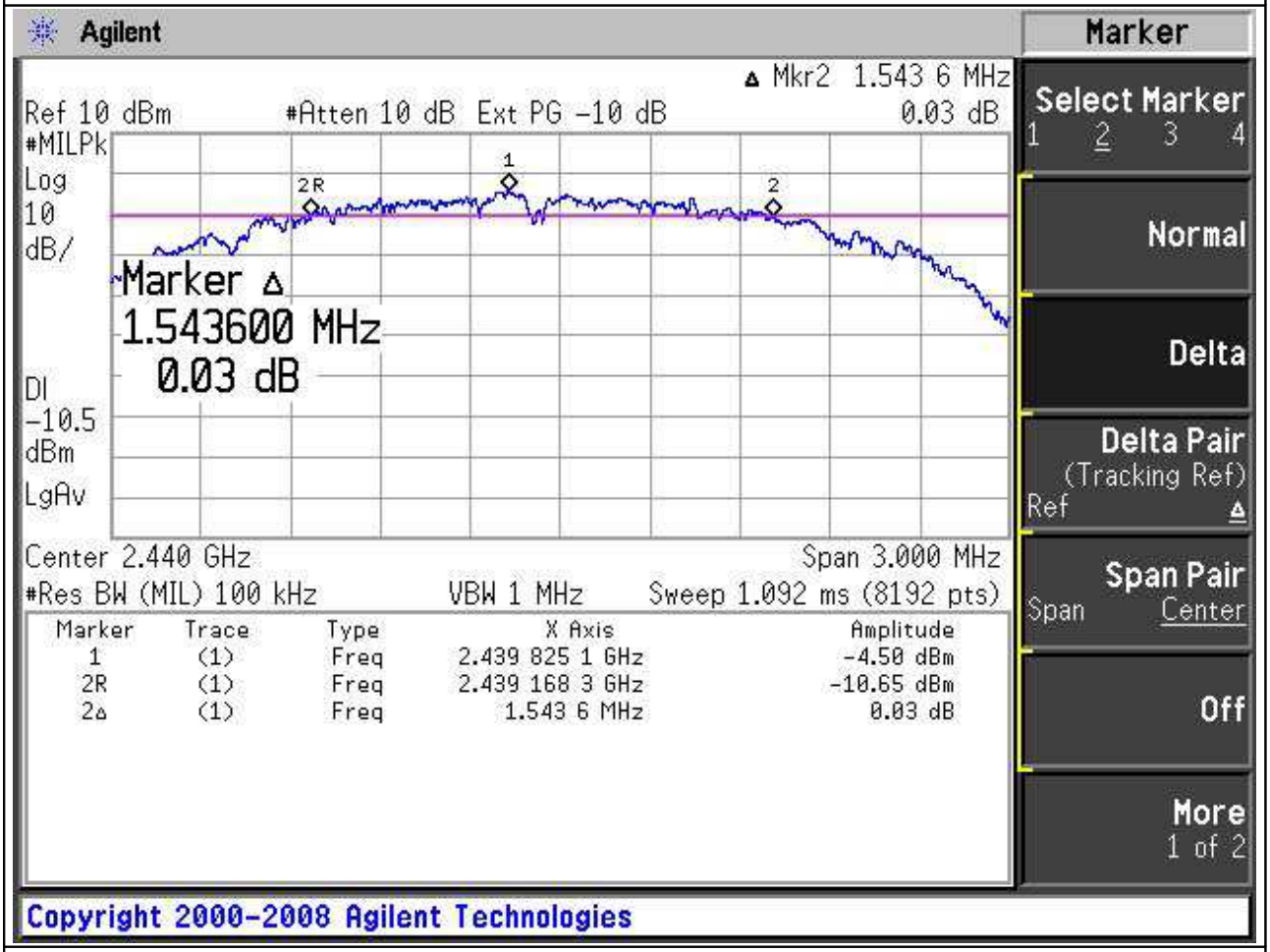


Bandwidth (6 dB): 1705 kHz

Note: [Setting:

- Power Output: maximum
- f = 2405 MHz]

Bandwidth
Mid Channel

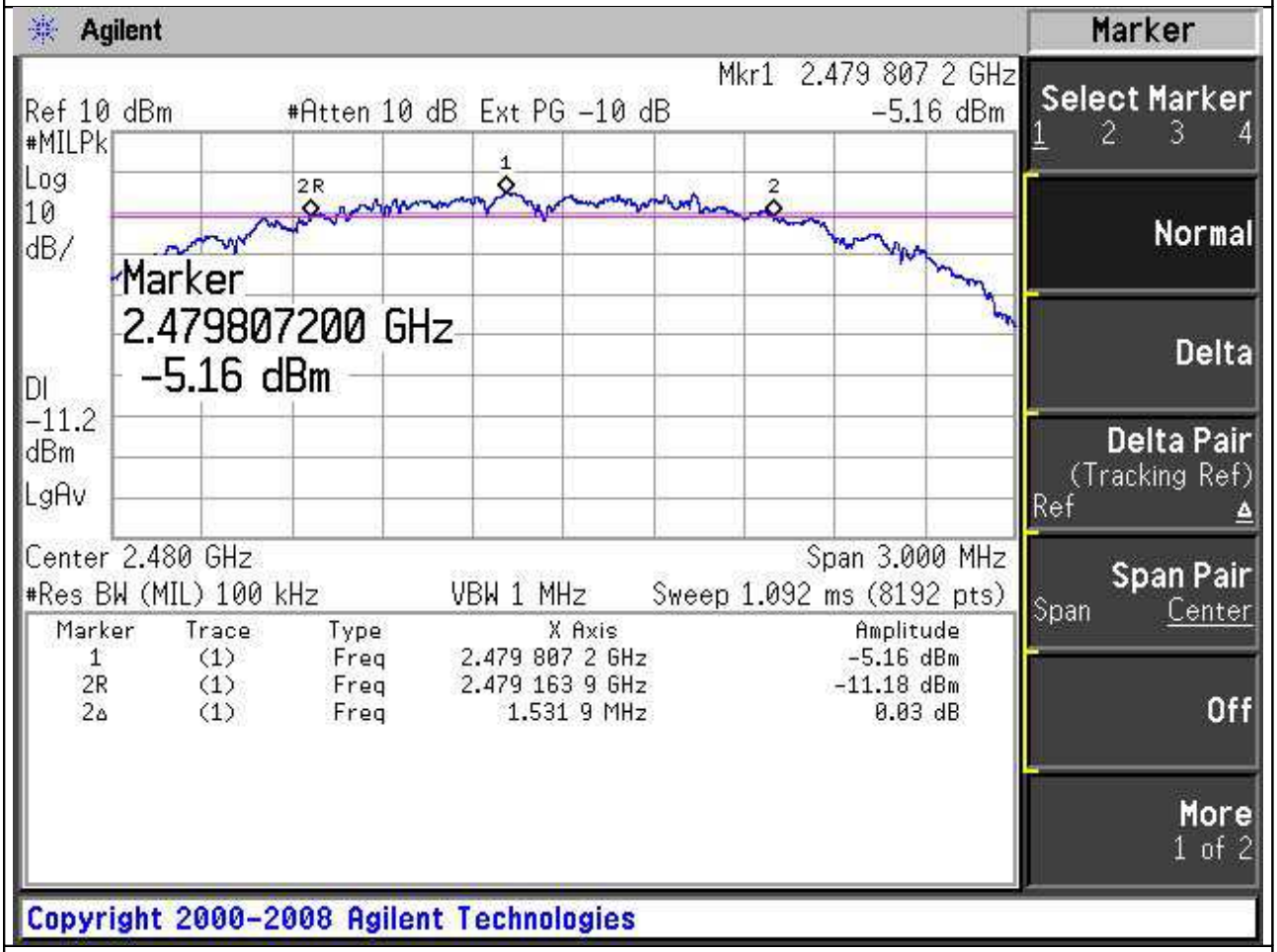


Bandwidth (6 dB): 1544 kHz

Note: [Setting:

- Power Output: maximum
- f = 2440 MHz]

Bandwidth
High Channel



Bandwidth (6 dB): 1532 kHz

Note: [Setting:

- Power Output: maximum
- f = 2480 MHz]

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

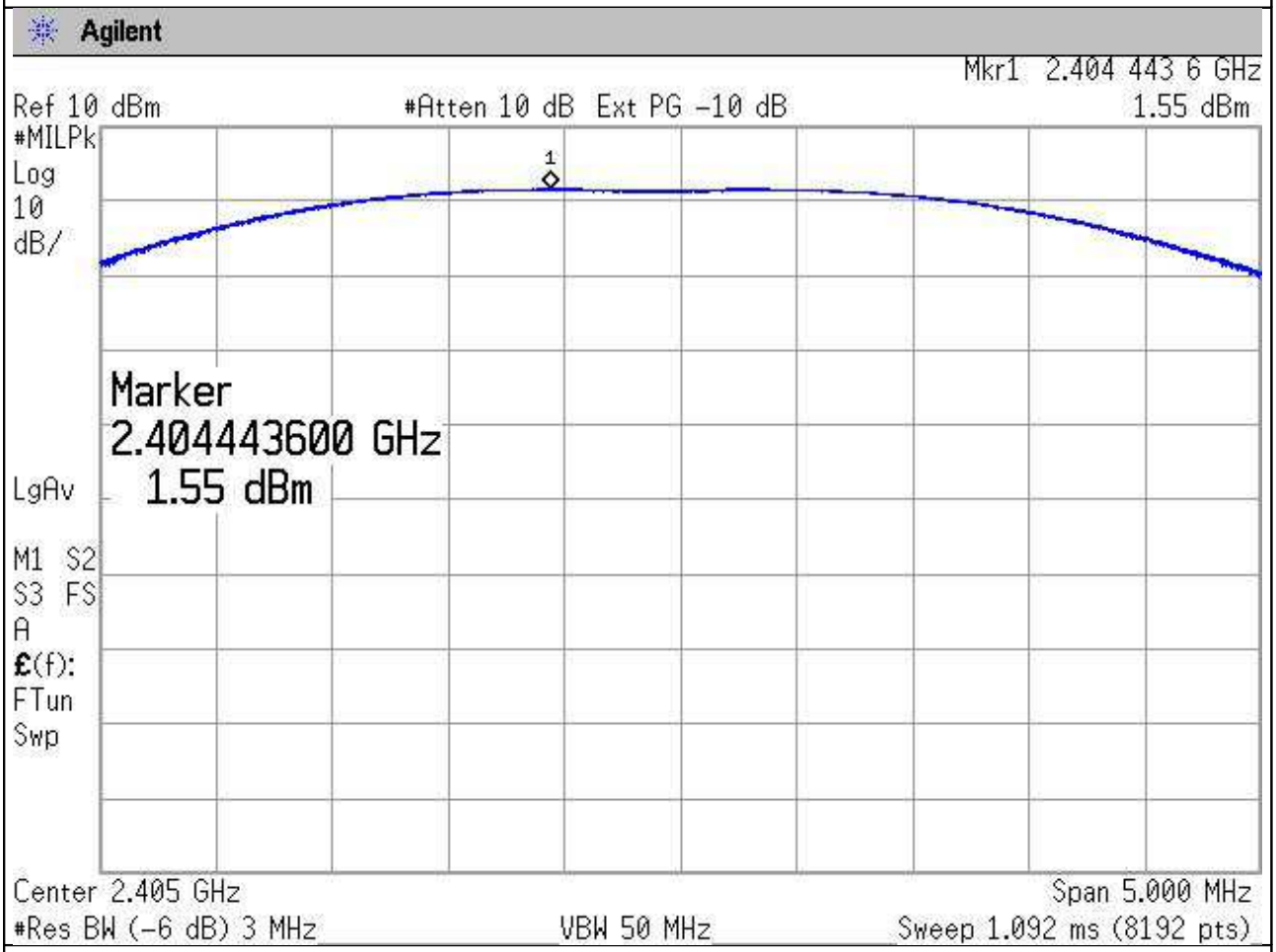
Test procedure: APR01

Results:

No non-compliance noted

Channel	*Frequency (MHz)*	*Peak Power (dBm)*	*Limit (dBm)*	*Margin (dB)*
Low	2405	1,55	30	-28,45
Mid	2440	1,26	30	-28,74
High	2480	0,84	30	-29,16

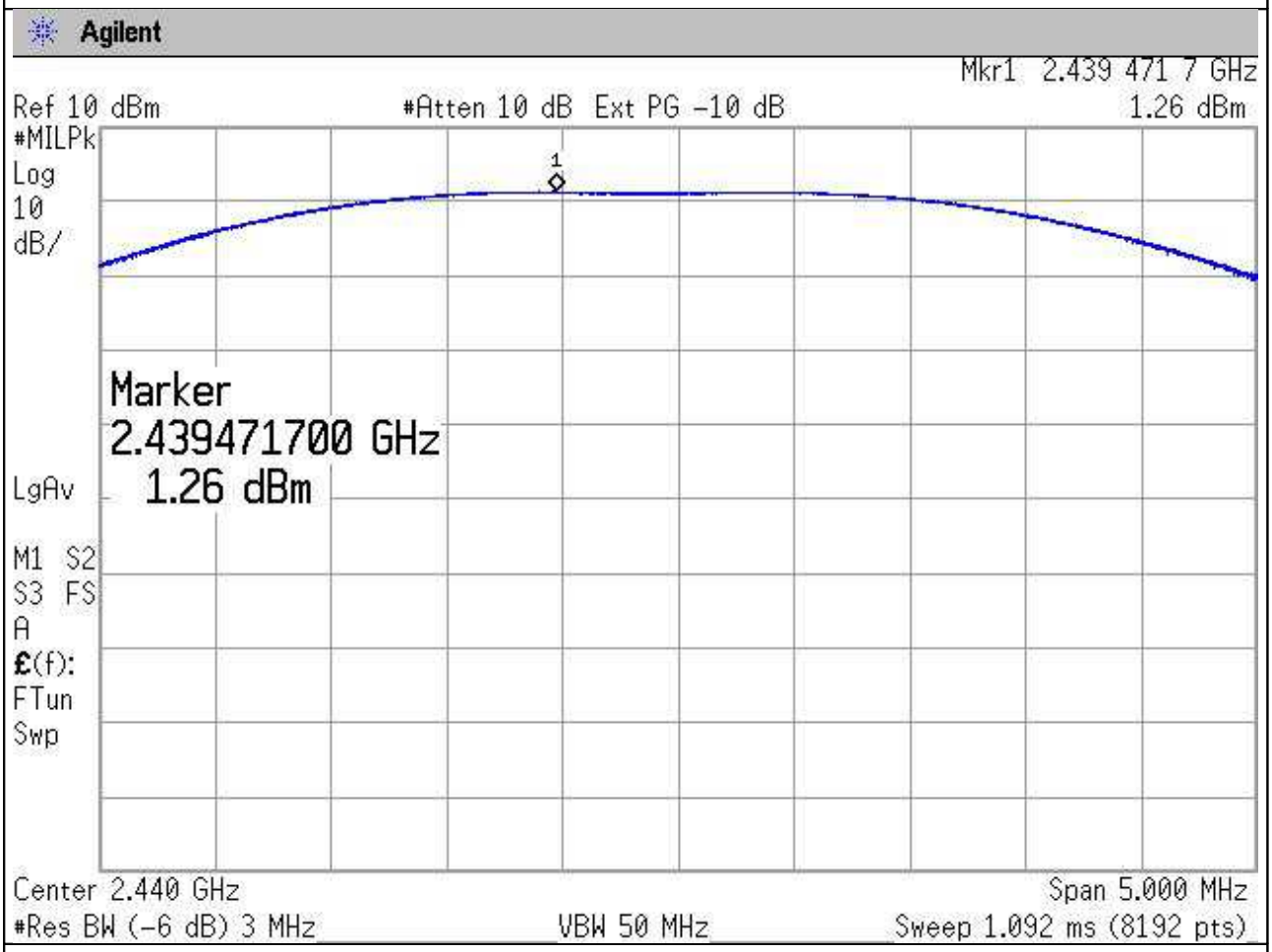
Maximum Peak Conducted Output Power
Low Channel



Note: [Setting:

- Power Output: maximum
- f = 2405 MHz]

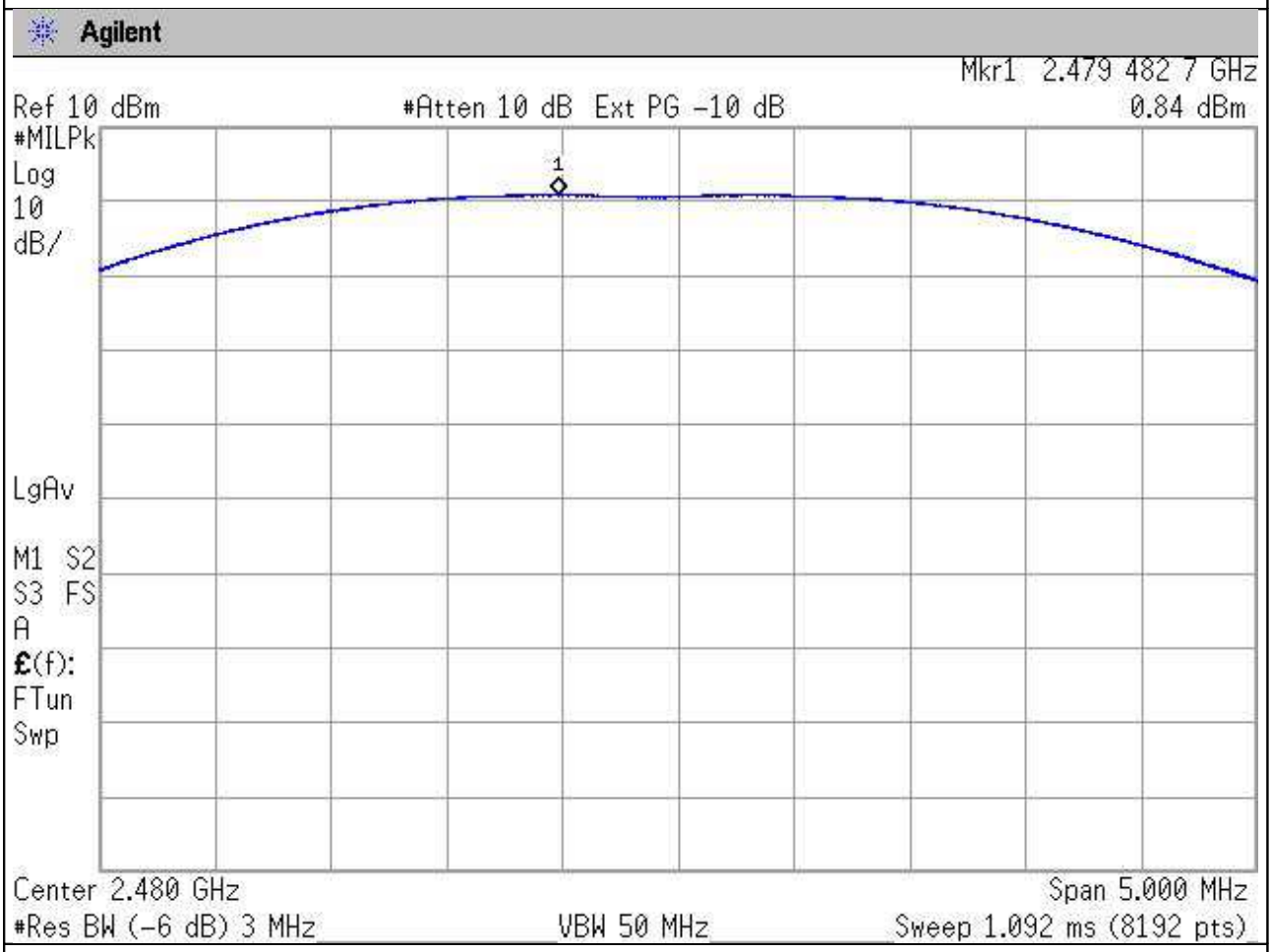
Maximum Peak Conducted Output Power
Mid Channel



Note: [Setting:

- Power Output: maximum
- f = 2440 MHz]

Maximum Peak Conducted Output Power
High Channel



Note: [Setting:

- Power Output: maximum
- f = 2480 MHz]

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

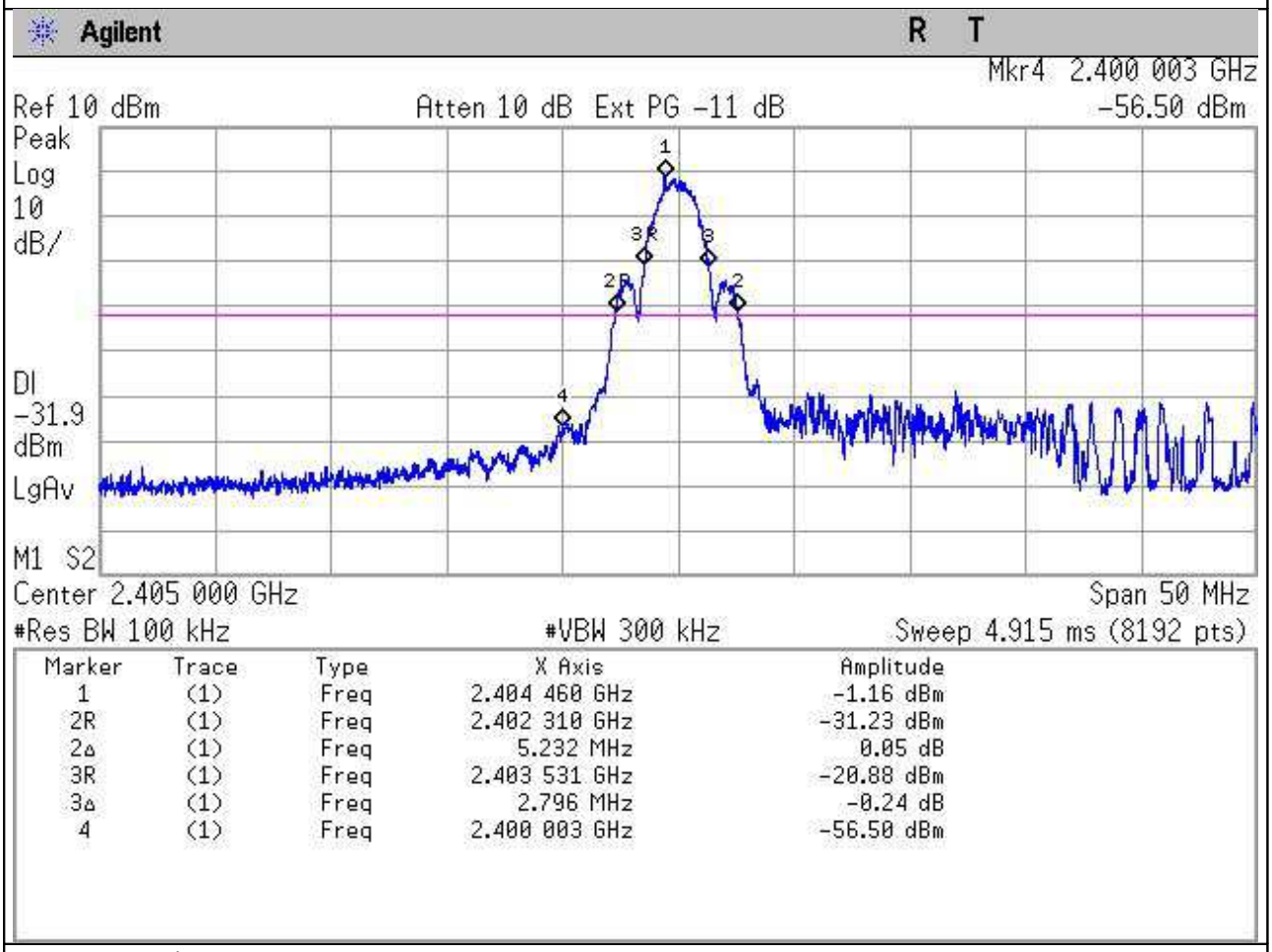
Test performed on low, middle and high channels.

Results:

No non-compliance noted

The following figures show the results.

Band-Edge Conducted
Low Channel

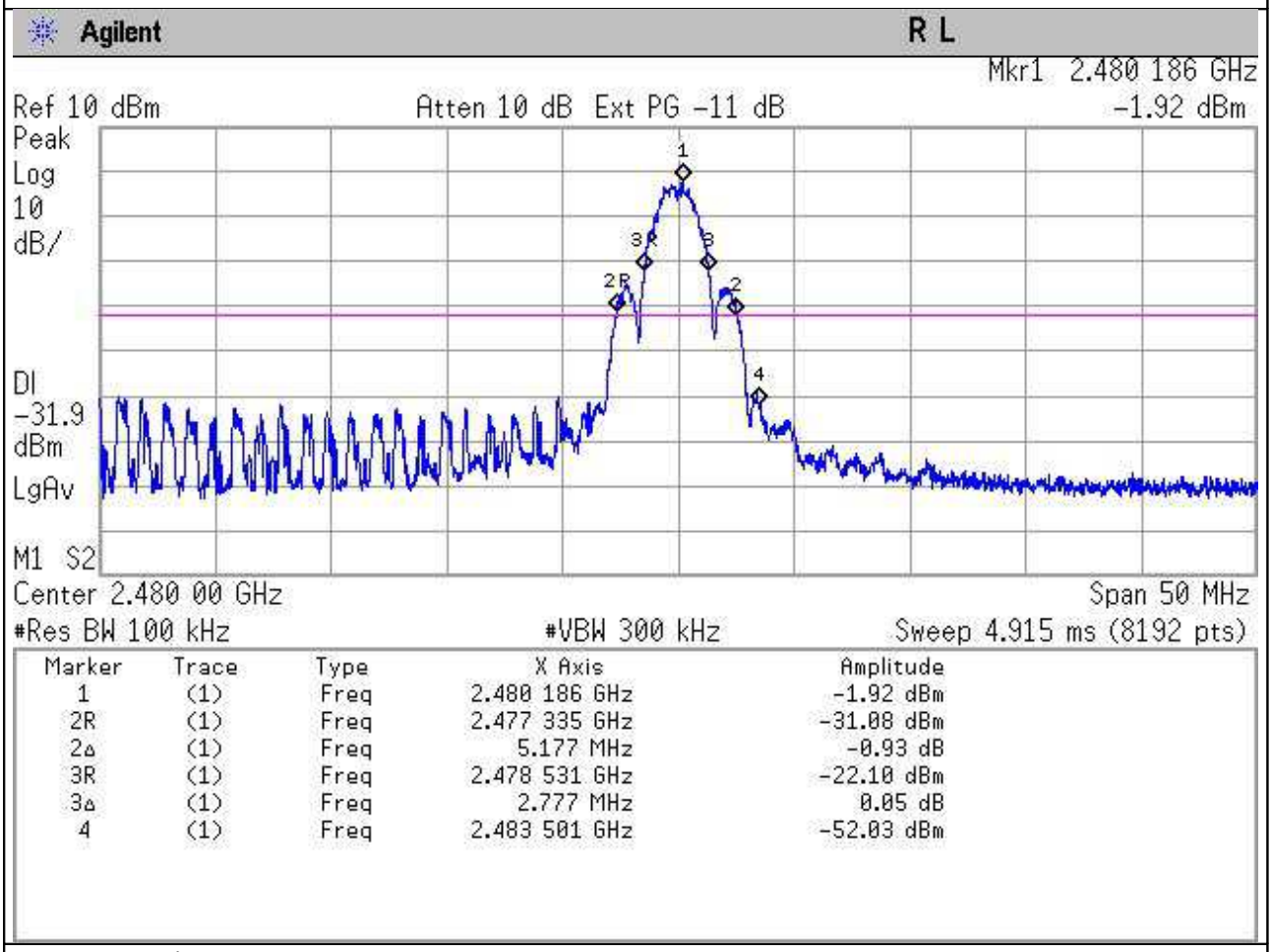


Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.404 460 GHz	-1.16 dBm
2R	(1)	Freq	2.402 310 GHz	-31.23 dBm
2Δ	(1)	Freq	5.232 MHz	0.05 dB
3R	(1)	Freq	2.403 531 GHz	-20.88 dBm
3Δ	(1)	Freq	2.796 MHz	-0.24 dB
4	(1)	Freq	2.400 003 GHz	-56.50 dBm

Note: [Setting:

- Power Output: maximum
- f = 2405 MHz]

Band-Edge Conducted
High Channel



Note: [Setting:

- Power Output: maximum
- f = 2480 MHz]

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

Channel	*Frequency (MHz)*	*PPSD (dBm)*	*Limit (dBm)*	*Margin (dB)*
Low	2405	-4,75	8	-12,75
Mid	2440	-5,47	8	-13,47
High	2480	-6,01	8	-14,01

The following figures show the results.


Agilent
Mkr1 2.404 802 0 GHz
Ref 18 dBm
Atten 20 dB Ext PG -17 dB
-4.75 dBm
Peak
Log
10
dB/
1
LgAv
M1 S2
S3 FS
f>50k
Swp
Center 2.405 000 0 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 3.267 ms (3501 pts)

Note:
CH 11


Agilent
Mkr1 2.440 184 3 GHz
Ref 18 dBm
Atten 20 dB Ext PG -17 dB
-5.47 dBm
Peak
Log
10
dB/
1
LgAv
M1 S2
S3 FS
f>50k
Swp
Center 2.440 000 0 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 3.267 ms (3501 pts)

Note:
CH 18


Agilent
Mkr1 2.479 801 1 GHz
Ref 18 dBm
Atten 20 dB Ext PG -17 dB
-6.01 dBm
Peak
Log
10
dB/
1
LgAv
M1 S2
S3 FS
f>50k
Swp
Center 2.480 000 0 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 3.267 ms (3501 pts)

Note:
CH 26

8. RADIATED EMISSIONS

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

FCC

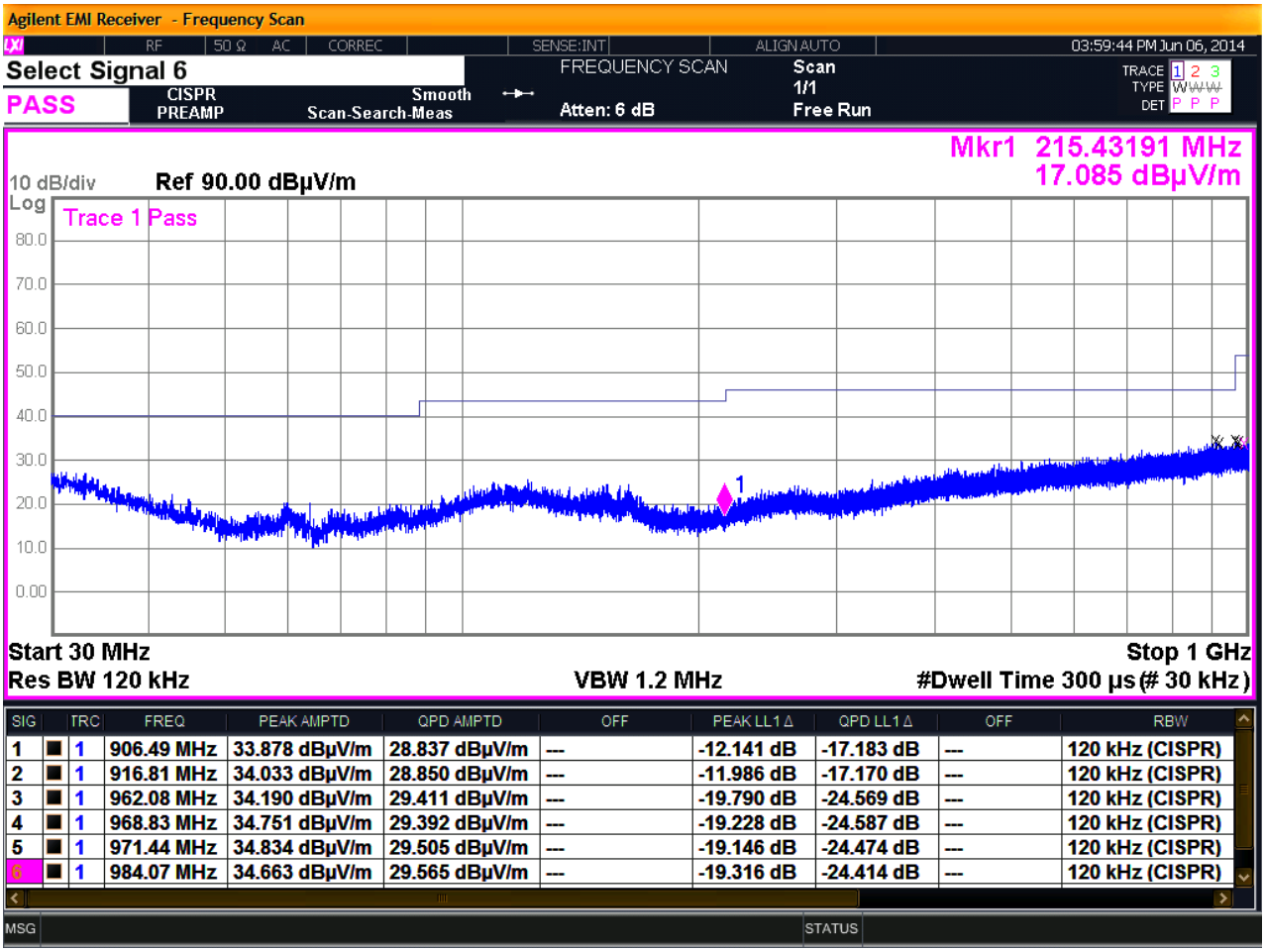
DISTANCE (m)	*FREQUENCY RANGE (MHz)*	*QUASI-PEAK LIMITS [dB (µV/m)]*	*AVERAGE LIMITS [dB (µV/m)]*
300	0,009 – 0,49	48,52 – 13,8	
30	0,049 – 1,705	33,8 – 22,97	
30	1,705 - 30	29,54	
3	30 – 88	40	--
3	88 – 216	43,5	--
3	216 – 960	46	--
3	960 – 1000	54	--
3	Above 1000	--	54

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

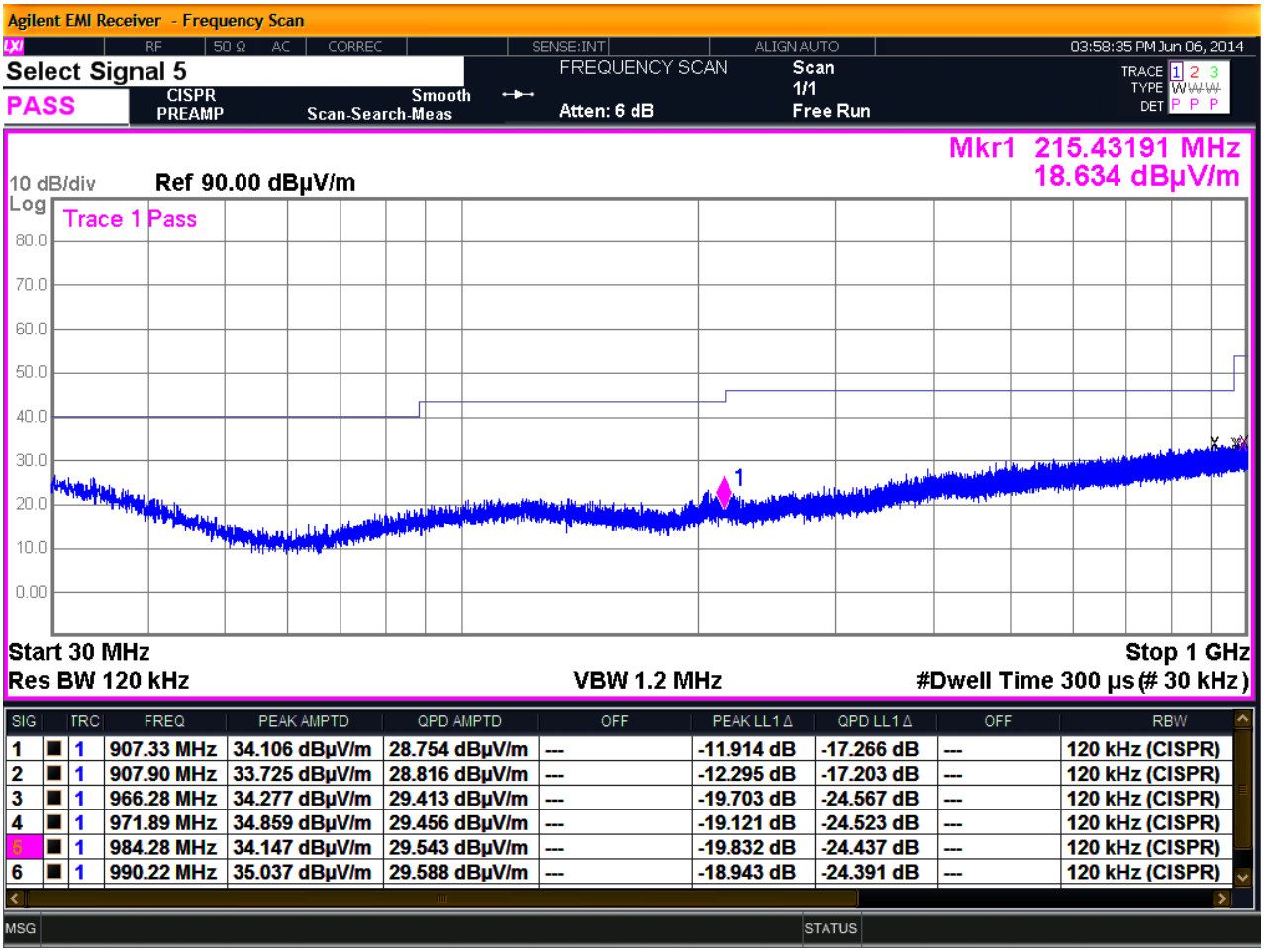
Test procedure: RE22R02

Notes
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.
Results and conclusions
In all the operative conditions, equipment complied with the standard limits. Graphics in following figures show the most significant registrations of the performed measurements.



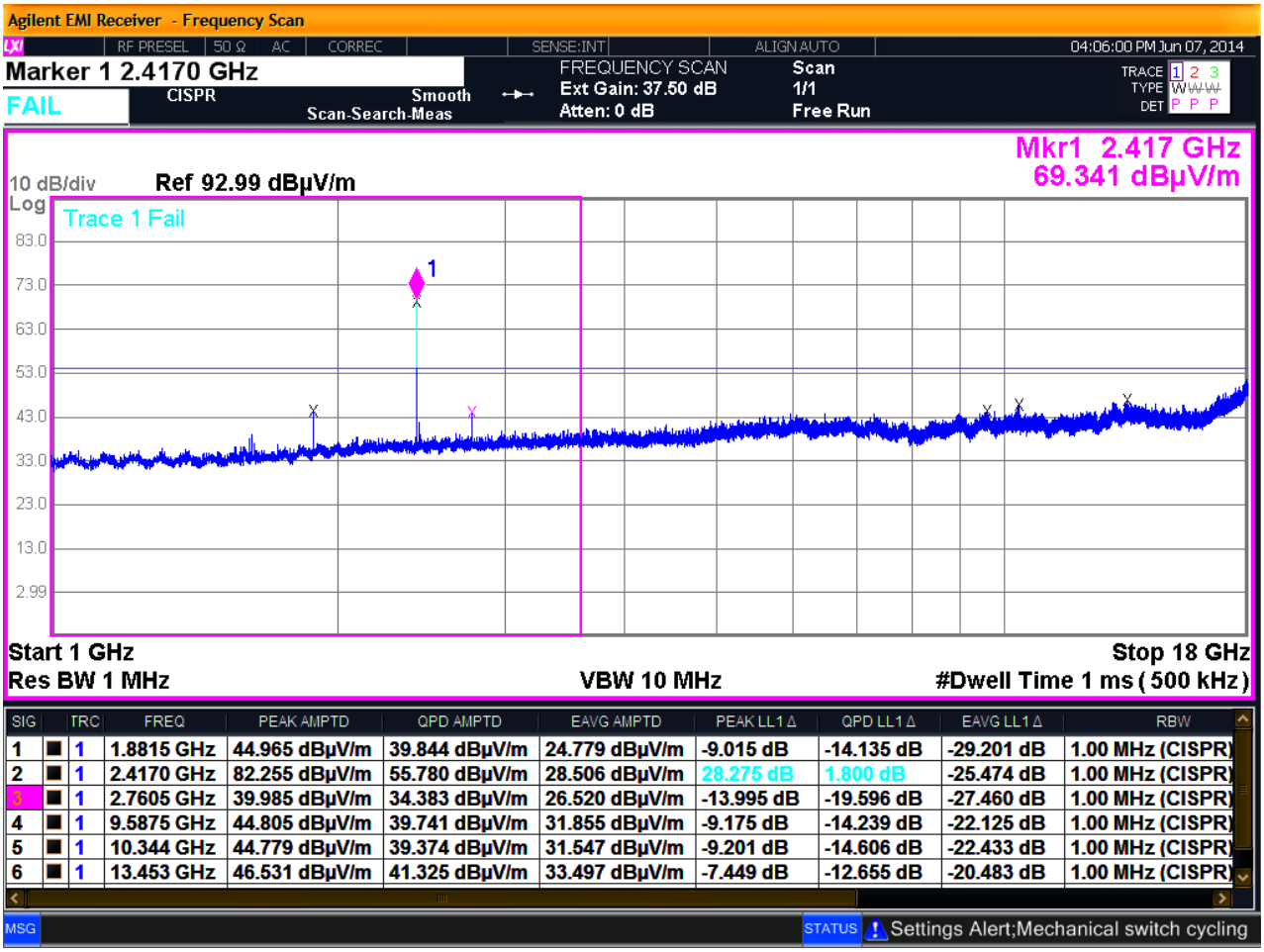
SIG	TRC	FREQ	PEAK AMPTD	QPD AMPTD	OFF	PEAK LL1 Δ	QPD LL1 Δ	OFF	RBW
1	1	906.49 MHz	33.878 dBµV/m	28.837 dBµV/m	---	-12.141 dB	-17.183 dB	---	120 kHz (CISPR)
2	1	916.81 MHz	34.033 dBµV/m	28.850 dBµV/m	---	-11.986 dB	-17.170 dB	---	120 kHz (CISPR)
3	1	962.08 MHz	34.190 dBµV/m	29.411 dBµV/m	---	-19.790 dB	-24.569 dB	---	120 kHz (CISPR)
4	1	968.83 MHz	34.751 dBµV/m	29.392 dBµV/m	---	-19.228 dB	-24.587 dB	---	120 kHz (CISPR)
5	1	971.44 MHz	34.834 dBµV/m	29.505 dBµV/m	---	-19.146 dB	-24.474 dB	---	120 kHz (CISPR)
6	1	984.07 MHz	34.663 dBµV/m	29.565 dBµV/m	---	-19.316 dB	-24.414 dB	---	120 kHz (CISPR)

VERTICAL POLARIZATION



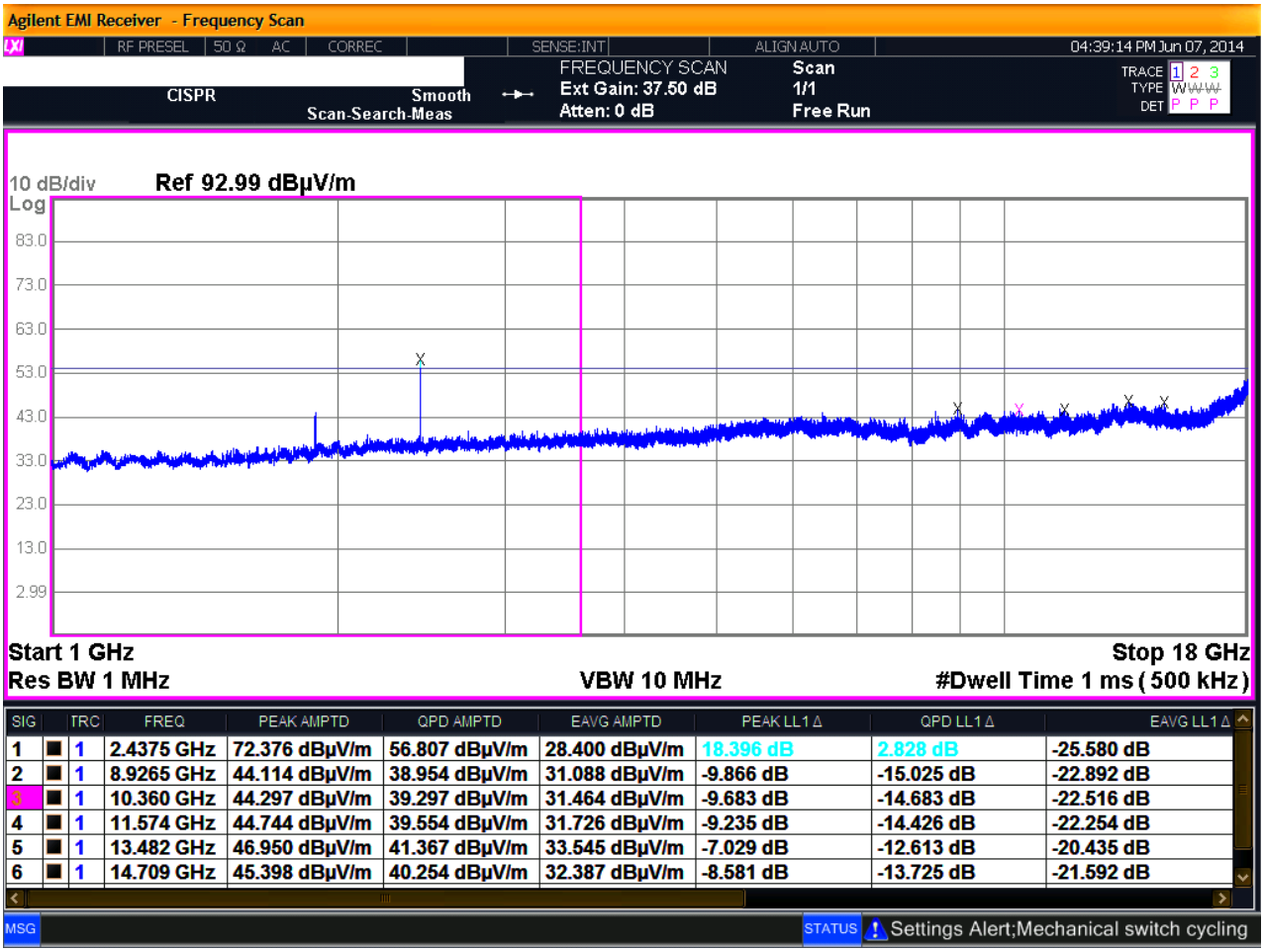
SIG	TRC	FREQ	PEAK AMPTD	QPD AMPTD	OFF	PEAK LL1 Δ	QPD LL1 Δ	OFF	RBW
1	1	907.33 MHz	34.106 dBµV/m	28.754 dBµV/m	---	-11.914 dB	-17.266 dB	---	120 kHz (CISPR)
2	1	907.90 MHz	33.725 dBµV/m	28.816 dBµV/m	---	-12.295 dB	-17.203 dB	---	120 kHz (CISPR)
3	1	966.28 MHz	34.277 dBµV/m	29.413 dBµV/m	---	-19.703 dB	-24.567 dB	---	120 kHz (CISPR)
4	1	971.89 MHz	34.859 dBµV/m	29.456 dBµV/m	---	-19.121 dB	-24.523 dB	---	120 kHz (CISPR)
5	1	984.28 MHz	34.147 dBµV/m	29.543 dBµV/m	---	-19.832 dB	-24.437 dB	---	120 kHz (CISPR)
6	1	990.22 MHz	35.037 dBµV/m	29.588 dBµV/m	---	-18.943 dB	-24.391 dB	---	120 kHz (CISPR)

HORIZONTAL POLARIZATION



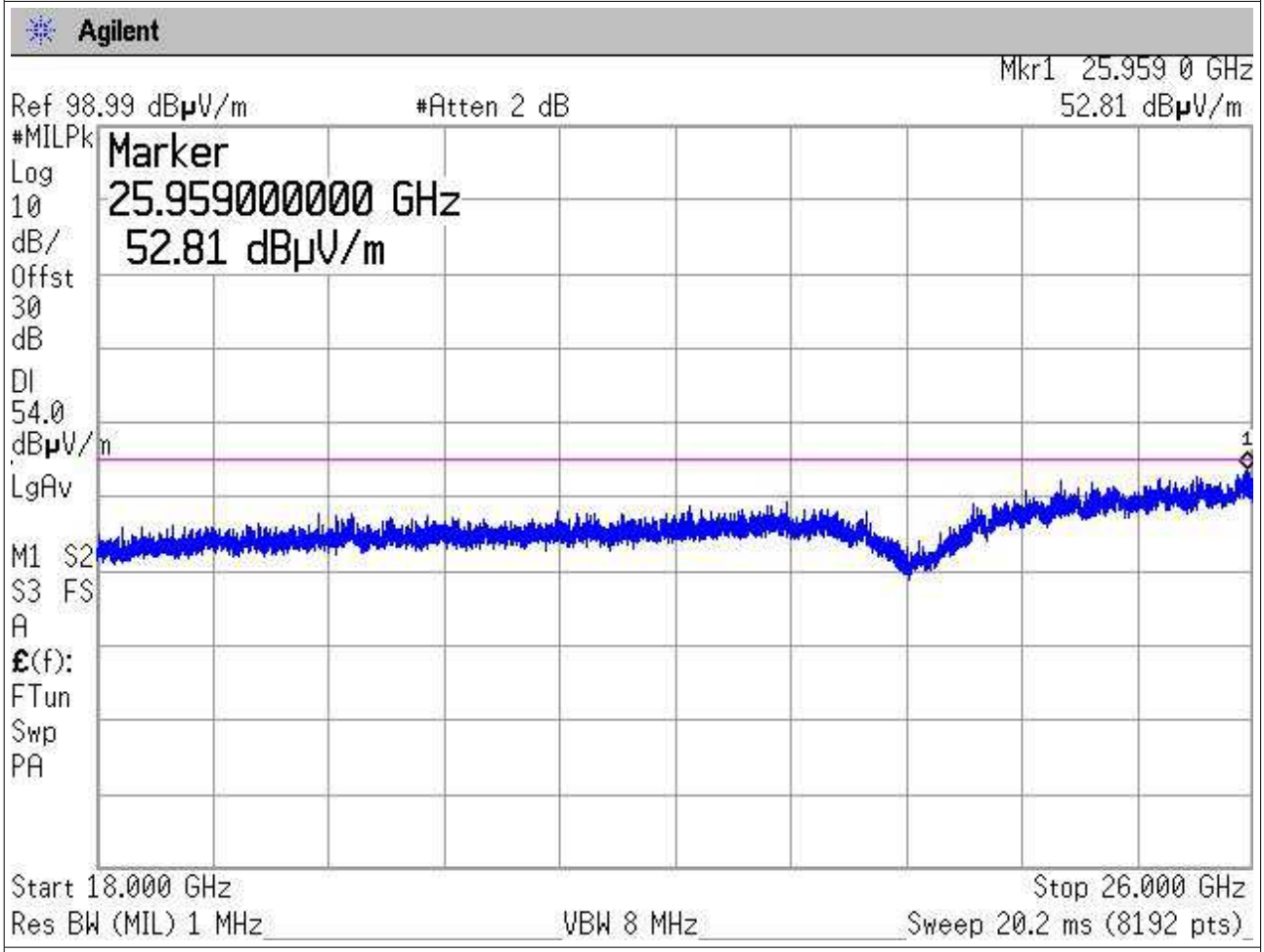
SIG	TRC	FREQ	PEAK AMPTD	QPD AMPTD	EAVG AMPTD	PEAK LL1 Δ	QPD LL1 Δ	EAVG LL1 Δ	RBW
1	1	1.8815 GHz	44.965 dBµV/m	39.844 dBµV/m	24.779 dBµV/m	-9.015 dB	-14.135 dB	-29.201 dB	1.00 MHz (CISPR)
2	1	2.4170 GHz	82.255 dBµV/m	55.780 dBµV/m	28.506 dBµV/m	28.275 dB	1.800 dB	-25.474 dB	1.00 MHz (CISPR)
3	1	2.7605 GHz	39.985 dBµV/m	34.383 dBµV/m	26.520 dBµV/m	-13.995 dB	-19.596 dB	-27.460 dB	1.00 MHz (CISPR)
4	1	9.5875 GHz	44.805 dBµV/m	39.741 dBµV/m	31.855 dBµV/m	-9.175 dB	-14.239 dB	-22.125 dB	1.00 MHz (CISPR)
5	1	10.344 GHz	44.779 dBµV/m	39.374 dBµV/m	31.547 dBµV/m	-9.201 dB	-14.606 dB	-22.433 dB	1.00 MHz (CISPR)
6	1	13.453 GHz	46.531 dBµV/m	41.325 dBµV/m	33.497 dBµV/m	-7.449 dB	-12.655 dB	-20.483 dB	1.00 MHz (CISPR)

VERTICAL POLARIZATION

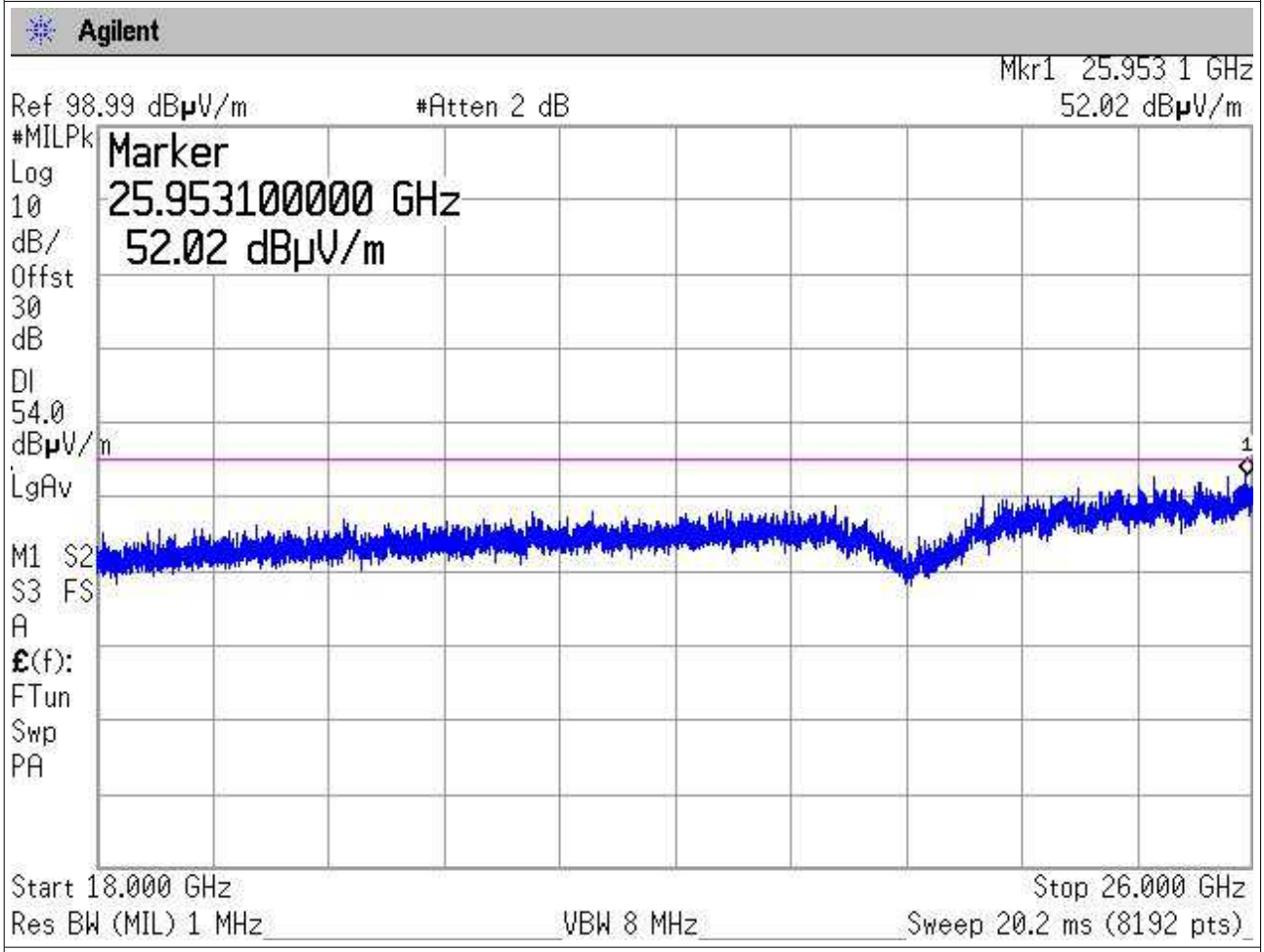


SIG	TRC	FREQ	PEAK AMPTD	QPD AMPTD	EAVG AMPTD	PEAK LL1 Δ	QPD LL1 Δ	EAVG LL1 Δ
1	1	2.4375 GHz	72.376 dBµV/m	56.807 dBµV/m	28.400 dBµV/m	18.396 dB	2.828 dB	-25.580 dB
2	1	8.9265 GHz	44.114 dBµV/m	38.954 dBµV/m	31.088 dBµV/m	-9.866 dB	-15.025 dB	-22.892 dB
3	1	10.360 GHz	44.297 dBµV/m	39.297 dBµV/m	31.464 dBµV/m	-9.683 dB	-14.683 dB	-22.516 dB
4	1	11.574 GHz	44.744 dBµV/m	39.554 dBµV/m	31.726 dBµV/m	-9.235 dB	-14.426 dB	-22.254 dB
5	1	13.482 GHz	46.950 dBµV/m	41.367 dBµV/m	33.545 dBµV/m	-7.029 dB	-12.613 dB	-20.435 dB
6	1	14.709 GHz	45.398 dBµV/m	40.254 dBµV/m	32.387 dBµV/m	-8.581 dB	-13.725 dB	-21.592 dB

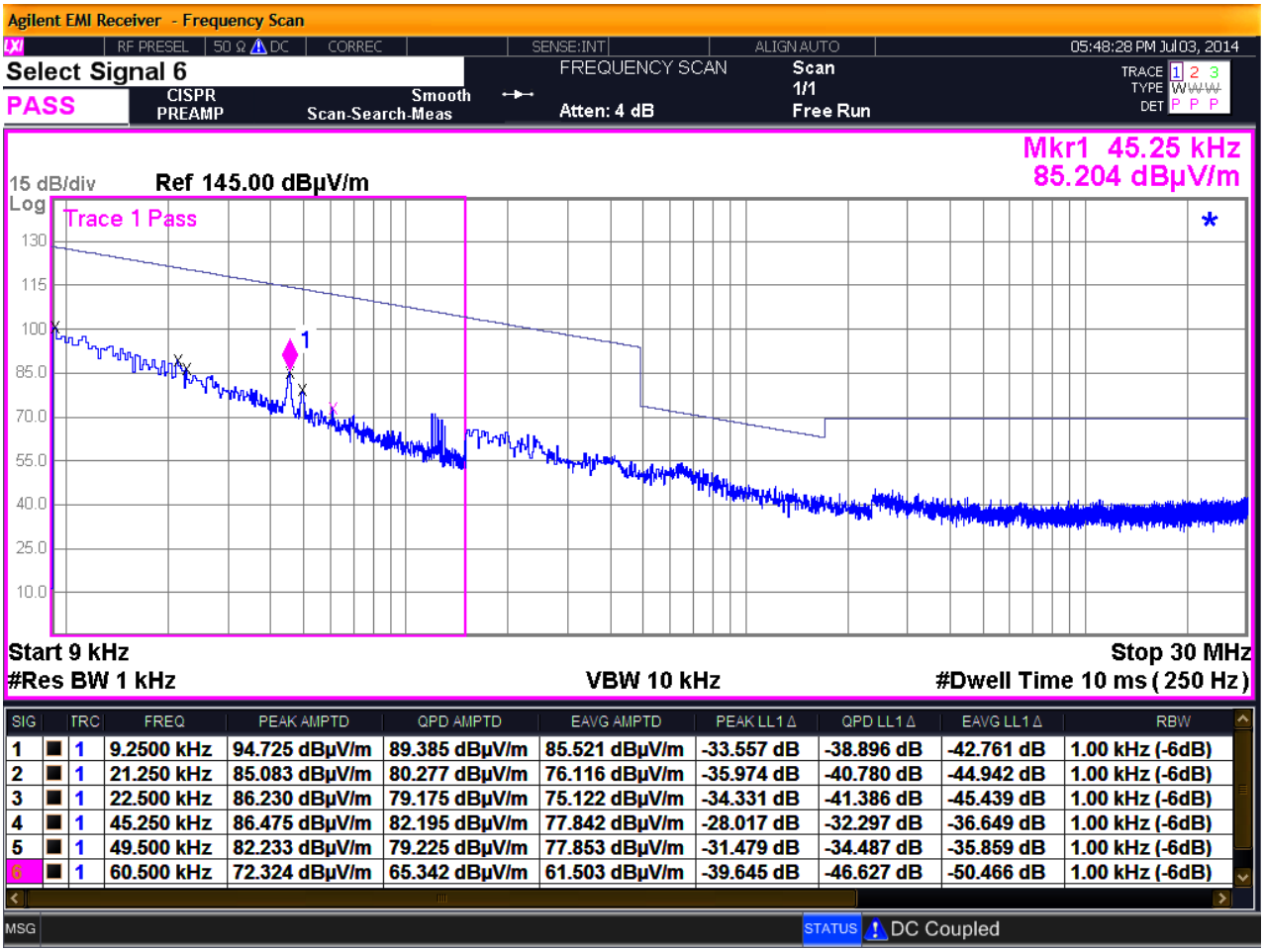
HORIZONTAL POLARIZATION



VERTICAL POLARIZATION



HORIZONTAL POLARIZATION



SIG	TRC	FREQ	PEAK AMPTD	QPD AMPTD	EAVG AMPTD	PEAK LL1 Δ	QPD LL1 Δ	EAVG LL1 Δ	RBW
1	1	9.2500 kHz	94.725 dBµV/m	89.385 dBµV/m	85.521 dBµV/m	-33.557 dB	-38.896 dB	-42.761 dB	1.00 kHz (-6dB)
2	1	21.250 kHz	85.083 dBµV/m	80.277 dBµV/m	76.116 dBµV/m	-35.974 dB	-40.780 dB	-44.942 dB	1.00 kHz (-6dB)
3	1	22.500 kHz	86.230 dBµV/m	79.175 dBµV/m	75.122 dBµV/m	-34.331 dB	-41.386 dB	-45.439 dB	1.00 kHz (-6dB)
4	1	45.250 kHz	86.475 dBµV/m	82.195 dBµV/m	77.842 dBµV/m	-28.017 dB	-32.297 dB	-36.649 dB	1.00 kHz (-6dB)
5	1	49.500 kHz	82.233 dBµV/m	79.225 dBµV/m	77.853 dBµV/m	-31.479 dB	-34.487 dB	-35.859 dB	1.00 kHz (-6dB)
6	1	60.500 kHz	72.324 dBµV/m	65.342 dBµV/m	61.503 dBµV/m	-39.645 dB	-46.627 dB	-50.466 dB	1.00 kHz (-6dB)

LOOP ANTENNA

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/cm^2 max at 20 cm of distance

Calculation:

$S= PG/4\pi d^2$

Result

Power Density Limit mW/cm^2	**Output Power (dBm) (mW)**	**Antenna Gain (dB) (numeric)**	**Power Density at 20cm mW/cm^2**
1	1,55 1,43	1,6 1,45	0,00041

(*) OET Bulletin 65

10. PHOTO

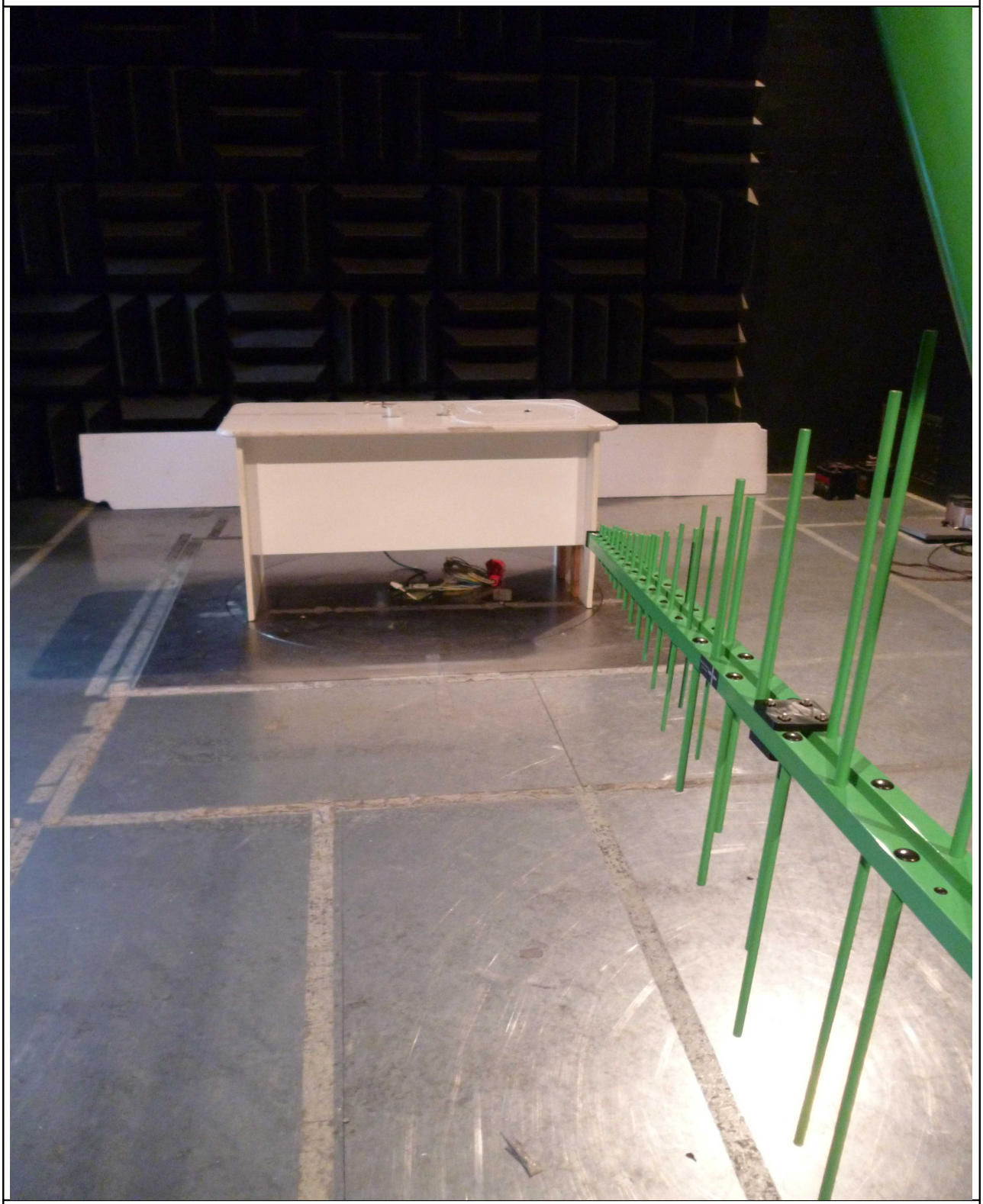


Fig. 10.1

Radiated Emissions Test Set-up

Fig. 10.2

Radiated Emissions Test Set-up

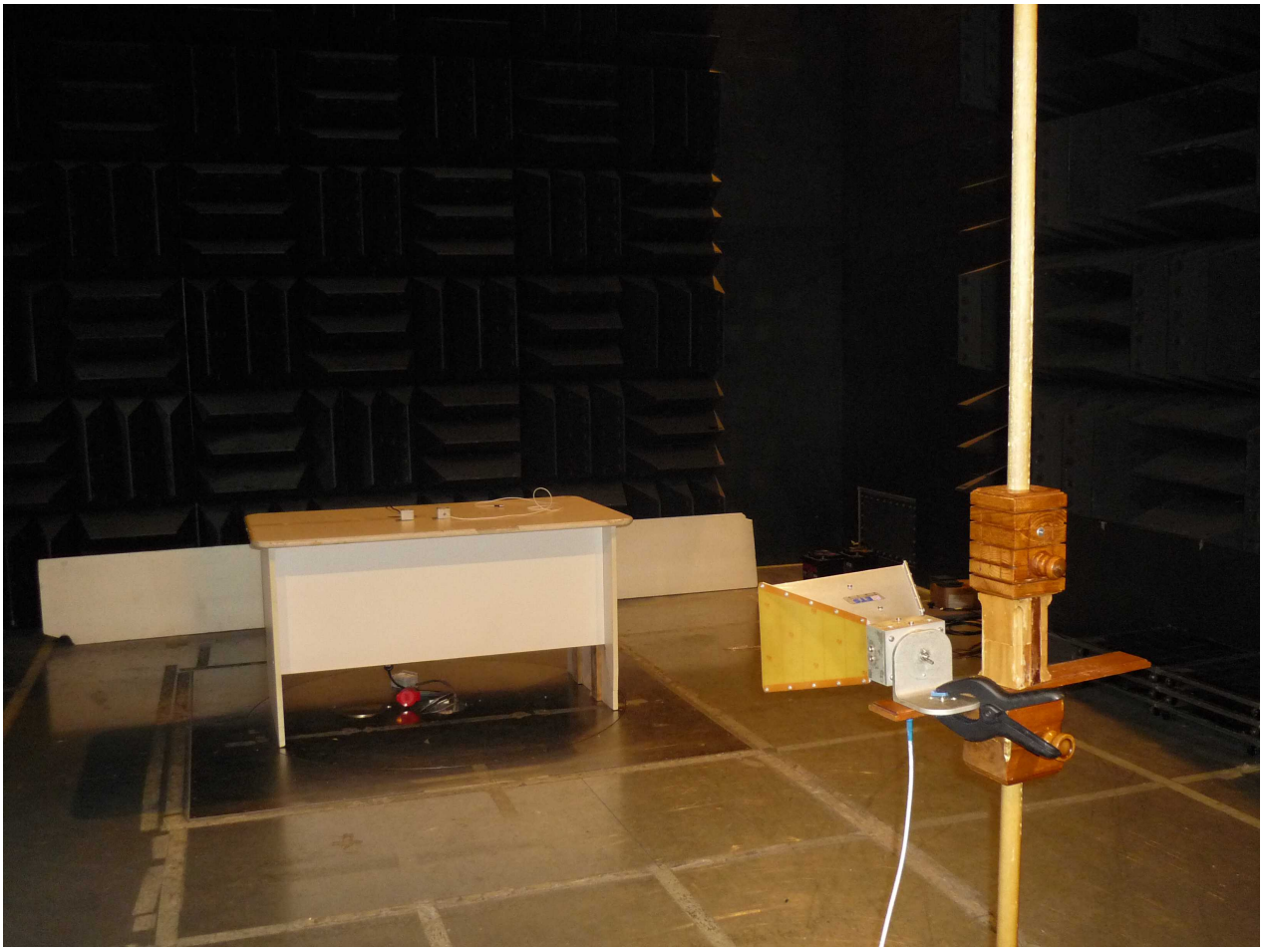


Fig. 10.3

Radiated Emissions Test Set-up