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SINCERT

G.S.D. S.r.l **PISA - Italy**	***Test Report n. 13221-FCC-IC***	Rev. 04

Manufacturer	**ABB S.p.A.**
Address	Via Statale 113 22016 Lenno Italy
Test Family Name	**WICB**
Frequency Range / RF Power Rating	2405-2480 MHz: 6,61 dBm
Bandwidths	2,859 MHz
Modulations	O-QPSK
Emission designators	2M86G1D
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 February 15

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	**ABB S.p.A..**
Address	Via Statale 113 22016 Lenno Italy
Test Family Name	**WICB**
Date of reception	**2012 March 08**
Sampling	**Laboratory sample for certification**
Test Item Description	**WiFi Device**
Nominal Input Voltage	**Internal Battery**
Software	
FCC ID	**2AC50-WICB**
IC ID	**12311A-WICB**
Frequency Range / RF Power Rating	2405-2480: 6,61 dBm
Bandwidths	2,859 MHz
Modulations	O-QPSK
Emission designators	2M86G1D
Antenna Information	Integral Antenna. Gain: 2dBi

[1]A detailed documentation is preserved in the internal fascicle.

Fig. 1.1
Equipment Under Test - Photo

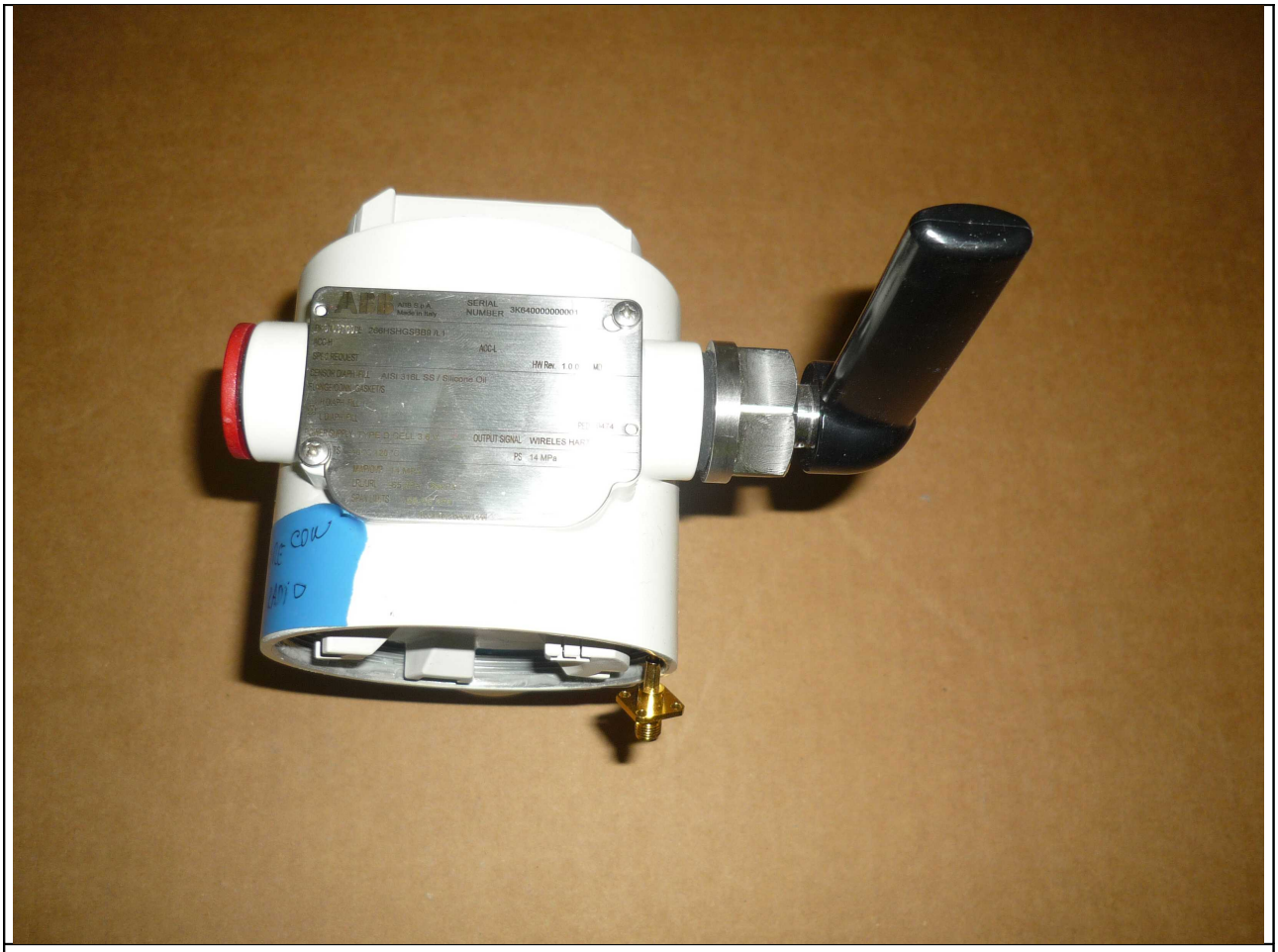


Fig. 1.2
Equipment Under Test - Photo

Fig. 1.3
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) and 15.247 (a)(1)(i)(iii), (b)(1)	FCC Rules ad Regulations, Title 47 (2008) Part 15 – Sub part B KDB 558074 D01 DTS Meas Guidance v03r02 ANSI C63.4 – 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 GHzGeneral
General Requirements for Compliance of Radio Apparatus	RSS-Gen Issue 4
Annex 8, Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz	RSS-210 Issue 8 Licence-exempr Radio Apparatus (All Frequency Bands): Category I Equipment
Maximum Permissible Exposure	OET Bulletin 65 Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields FCC Rules ad Regulations, Title 47 (2008) Part 15 – Sub part B

3. RESULT, CONDITION, MEASUREMENT UNCERTAINTY

Summary of Test Results

TEST	*RESULT*
6 dB bandwidht *Section 15.247 (a) (2)*	*Pass*
Peak Conducted Output Power: *Section 15.247 (b) (3)*	*Pass*
Band Edge *Section 15.247 (d)*	*Pass*
Power Spectral Density *Section 15.247 (e)*	*Pass*
Power Line Conducted Emissions *Section 15.207*	*Pass*
Radiated Emissions *Section 15.209*	*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) %

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

BW_{6dB} (MHz)	
Ch. Low	1,350
Ch. Mid	1,317
Ch. High	1,585

BW_{26dB} (MHz)	
Ch. Low	4,403
Ch. Mid	5,002
Ch. High	5,854

$BW_{99\%}$ (MHz)	
Ch. Low	2,405
Ch. Mid	2,570
Ch. High	2,859

Test Equipment

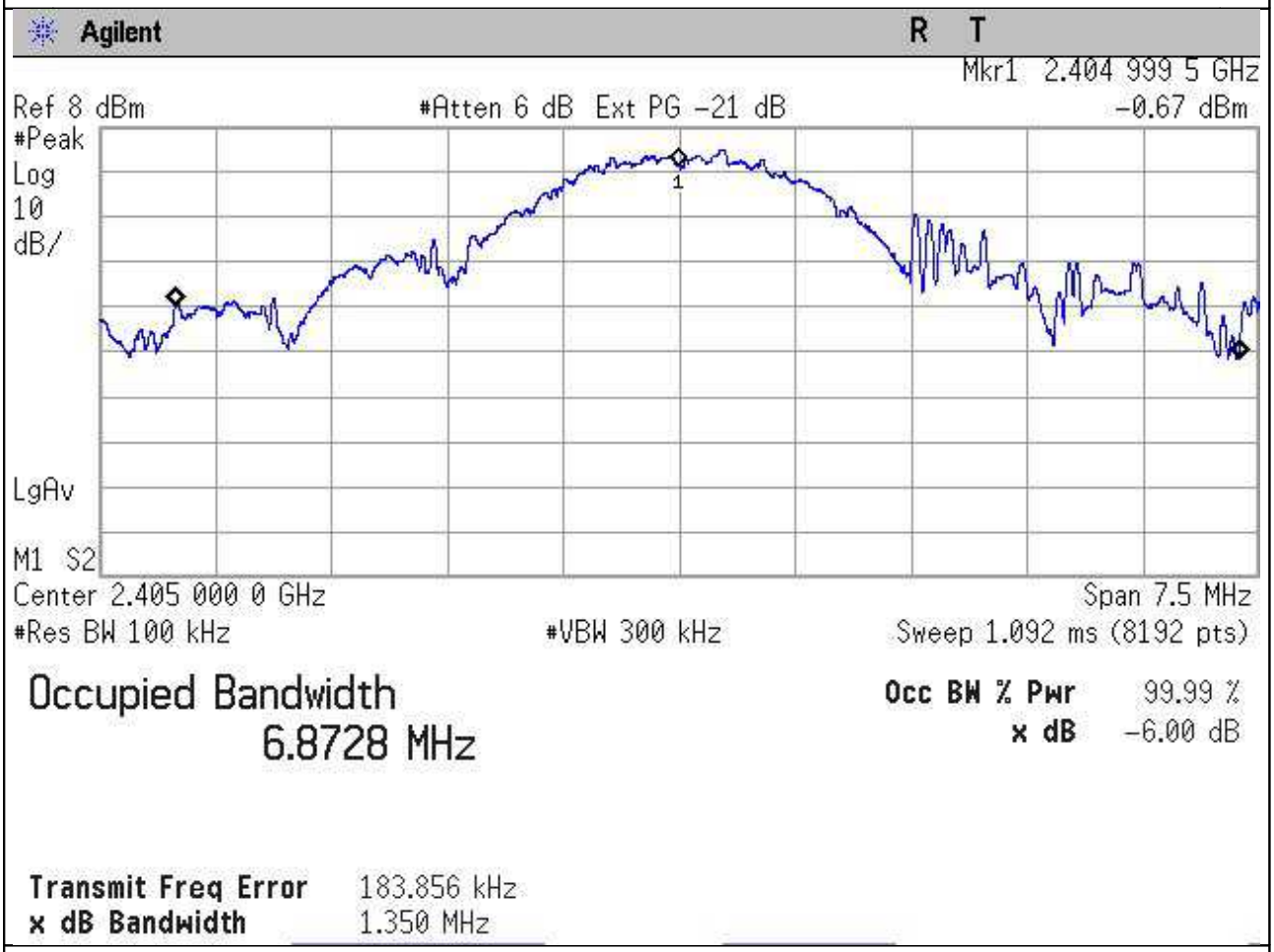
EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
EMI Receiver	Agilent	E4440A	01/2016

Test procedure: APR01

Test performed on low, middle and high channels

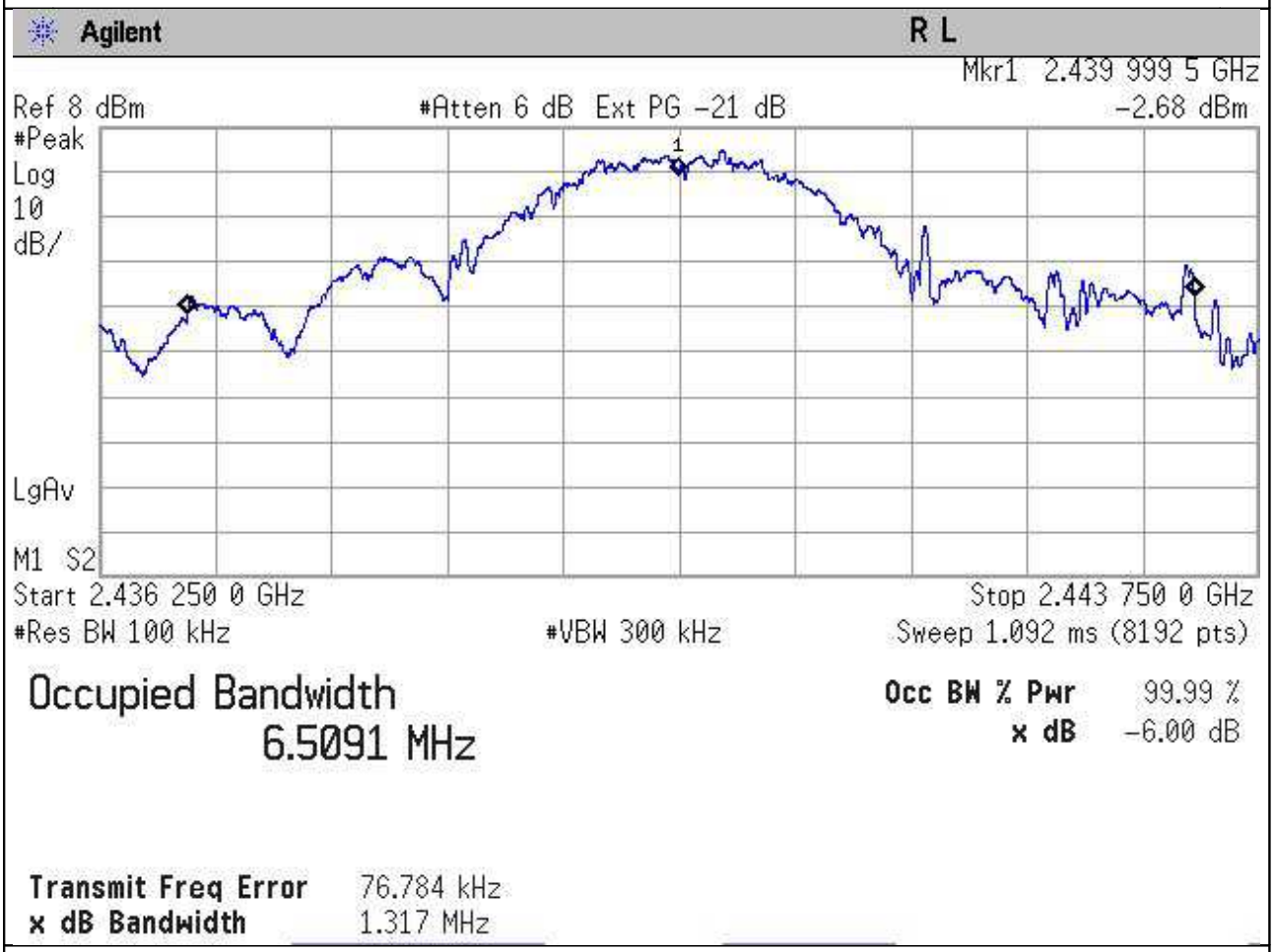
In the following graphs results are shown

6dB Bandwidth
Low Channel



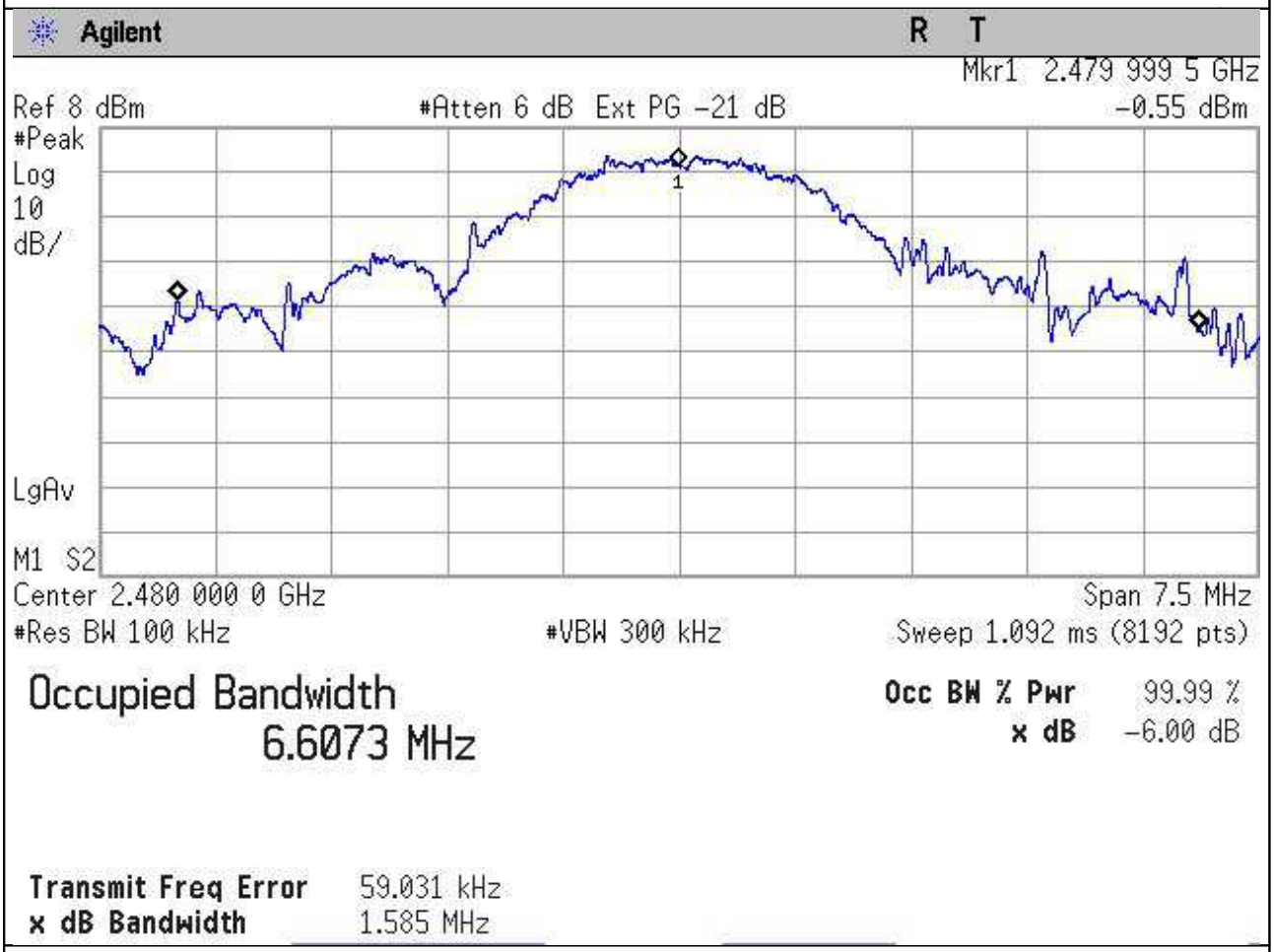
Note:

6dB Bandwidth
Mid Channel



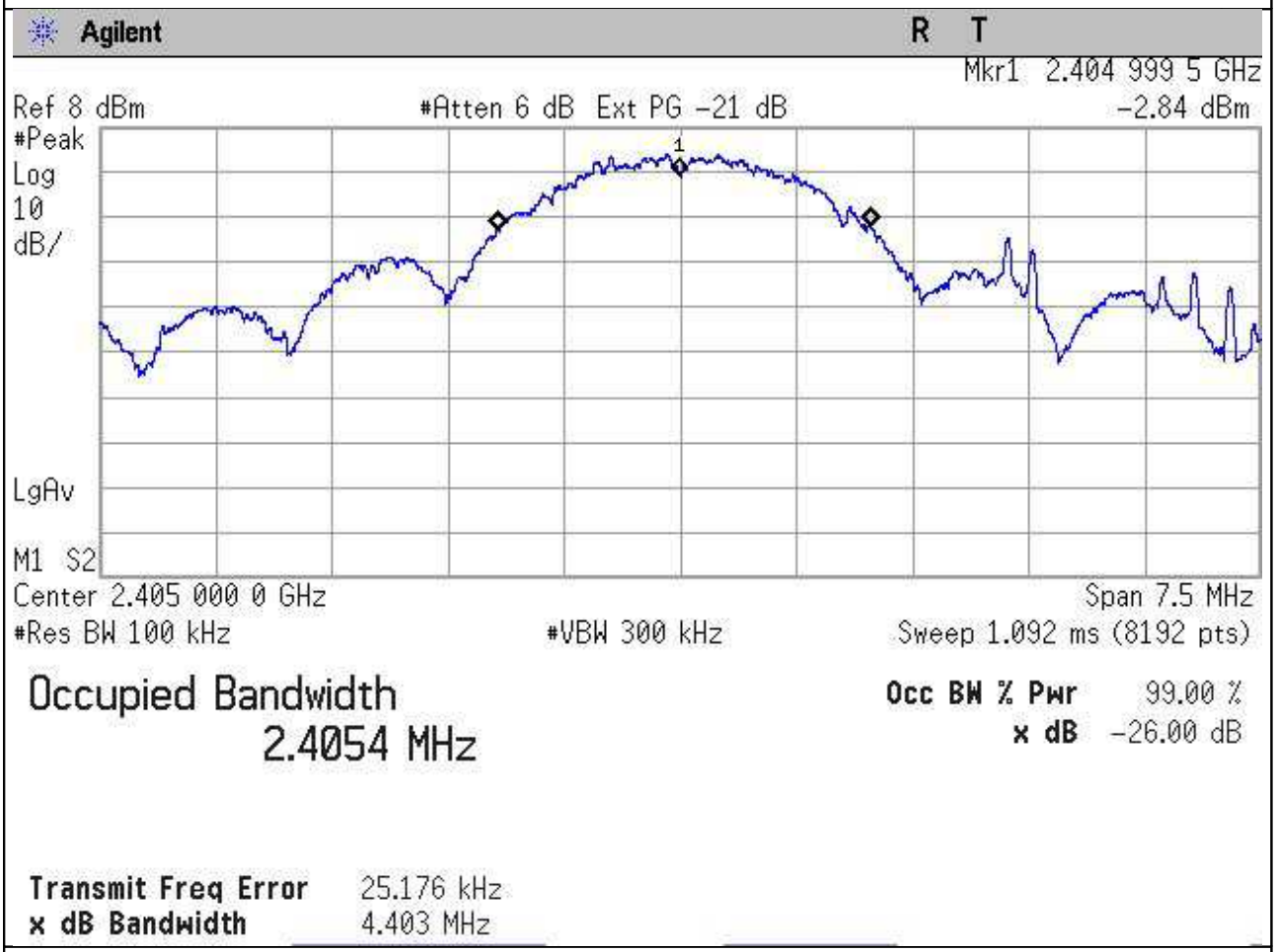
Note:

6dB Bandwidth
High Channel



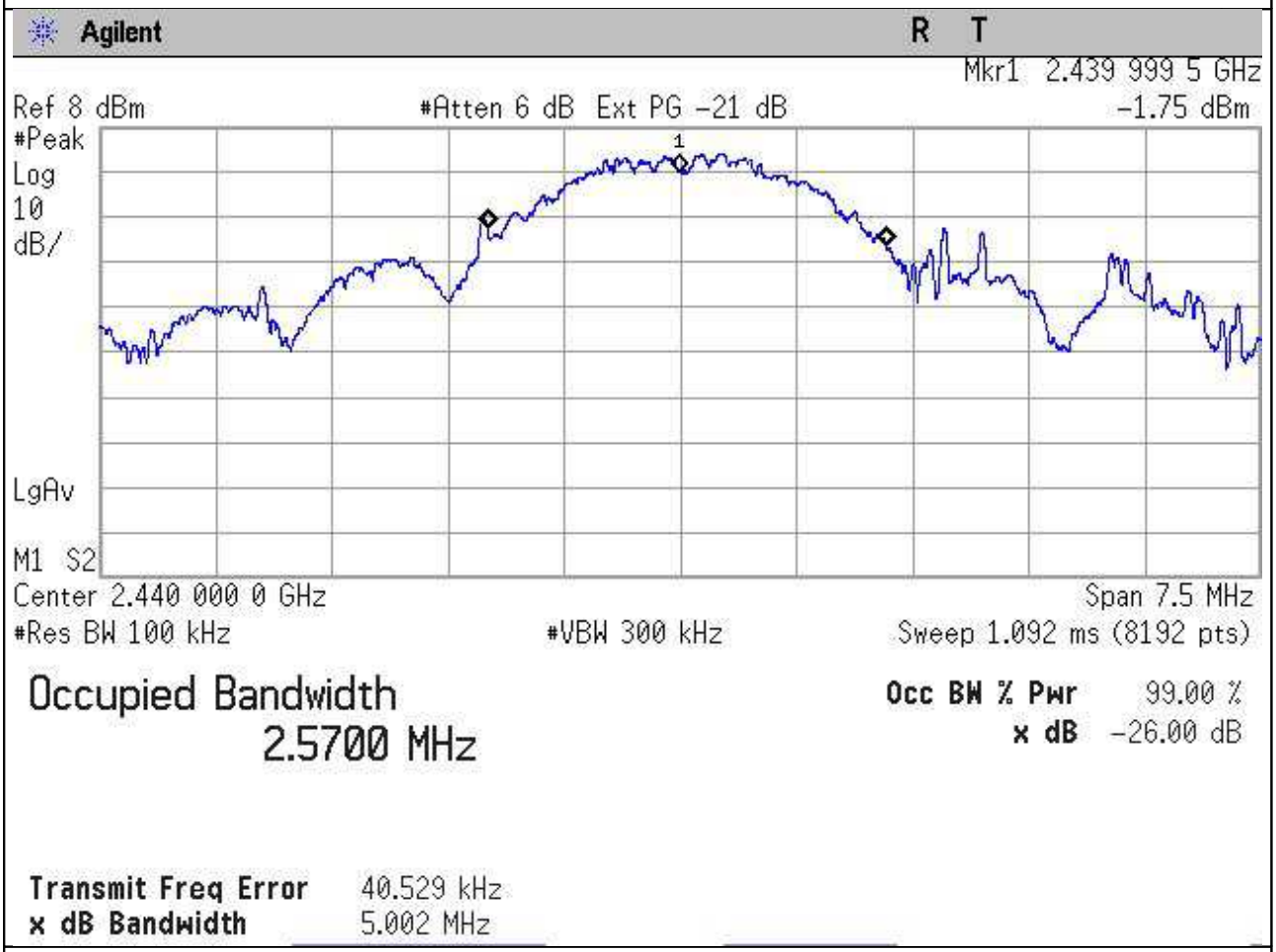
Note:

26dB/99% Bandwidths
Low Channel



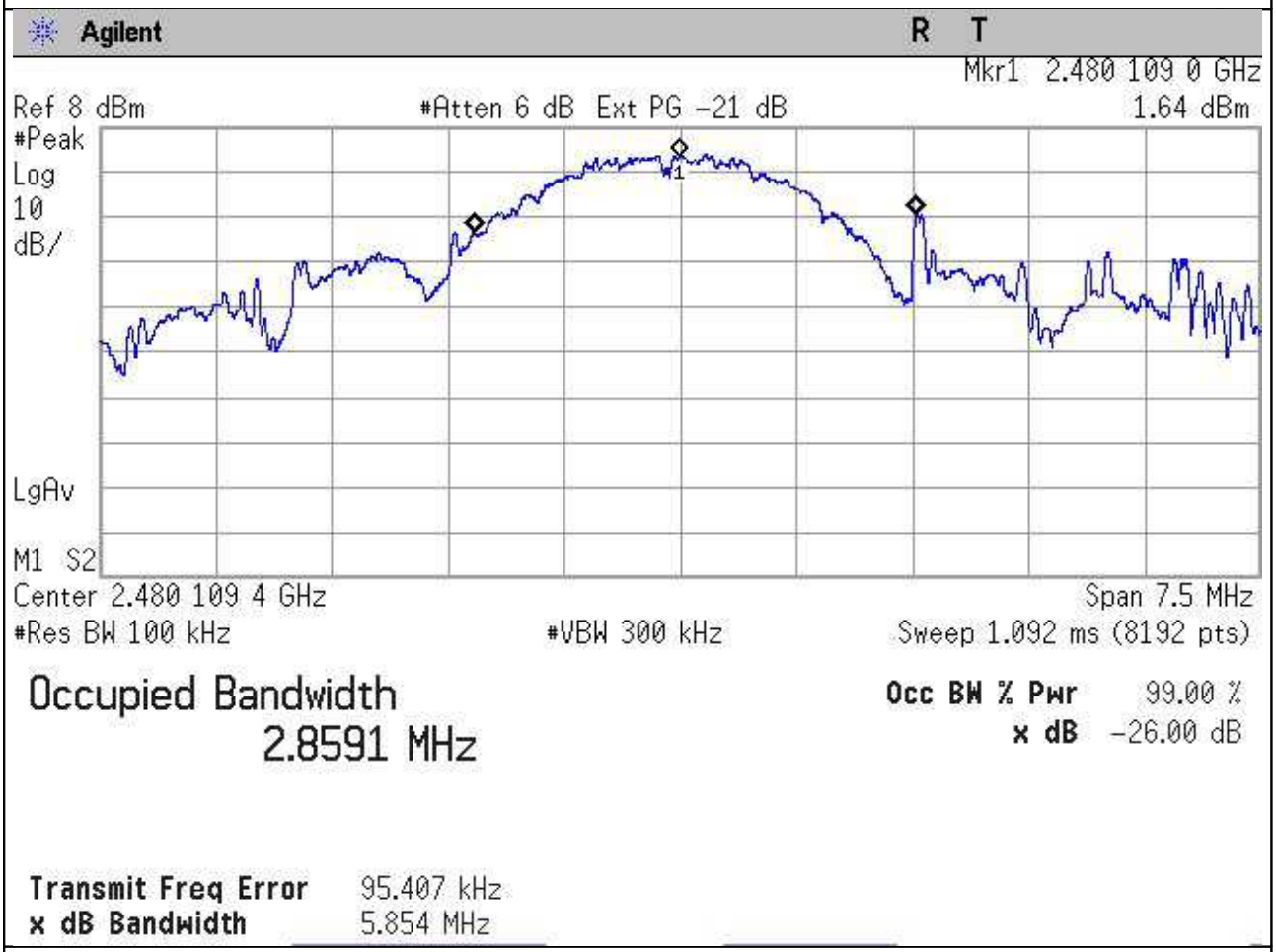
Note:

26dB/99% Bandwidths
Mid Channel



Note:

26dB/99% Bandwidths
High Channel



Note:

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. DUE
EMI Receiver	Agilent	E4440A	01/2016

Test procedure: APR01

The transmitter output is connected to a spectrum analyzer and the analyzer internal channel power integration is used to integrate the power over a bandwidth greater than or equal to the 26 dB bandwidth.

Test performed on low, middle and high channels.

Results:

Pass

Channel Power (dBm)	
Ch. Low	6,61
Ch. Mid	6,22
Ch. High	6,14

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. DUE
EMI Receiver	Agilent	E4440A	01/2016

Test procedure: APR01

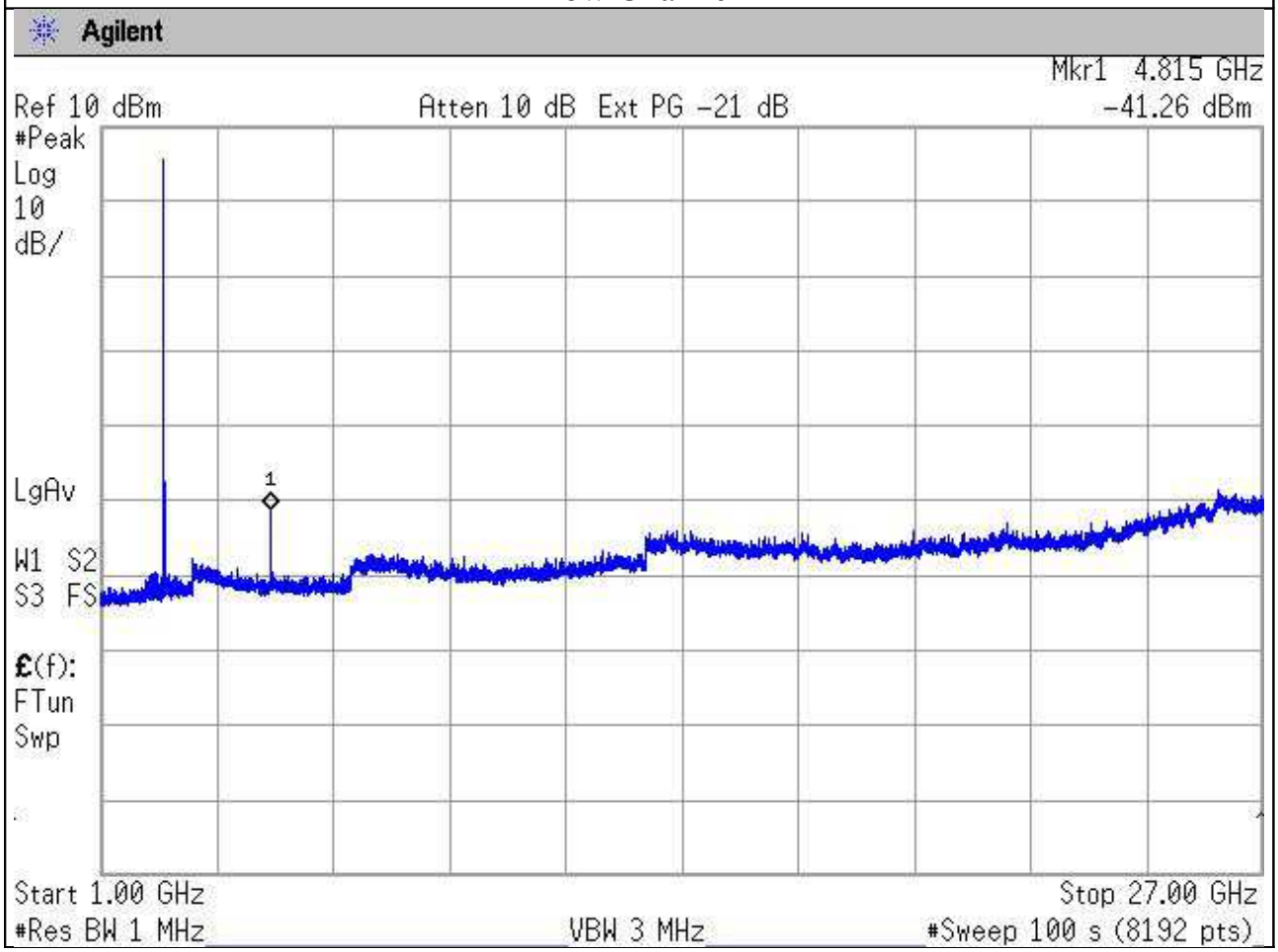
Test performed on low and high channels.

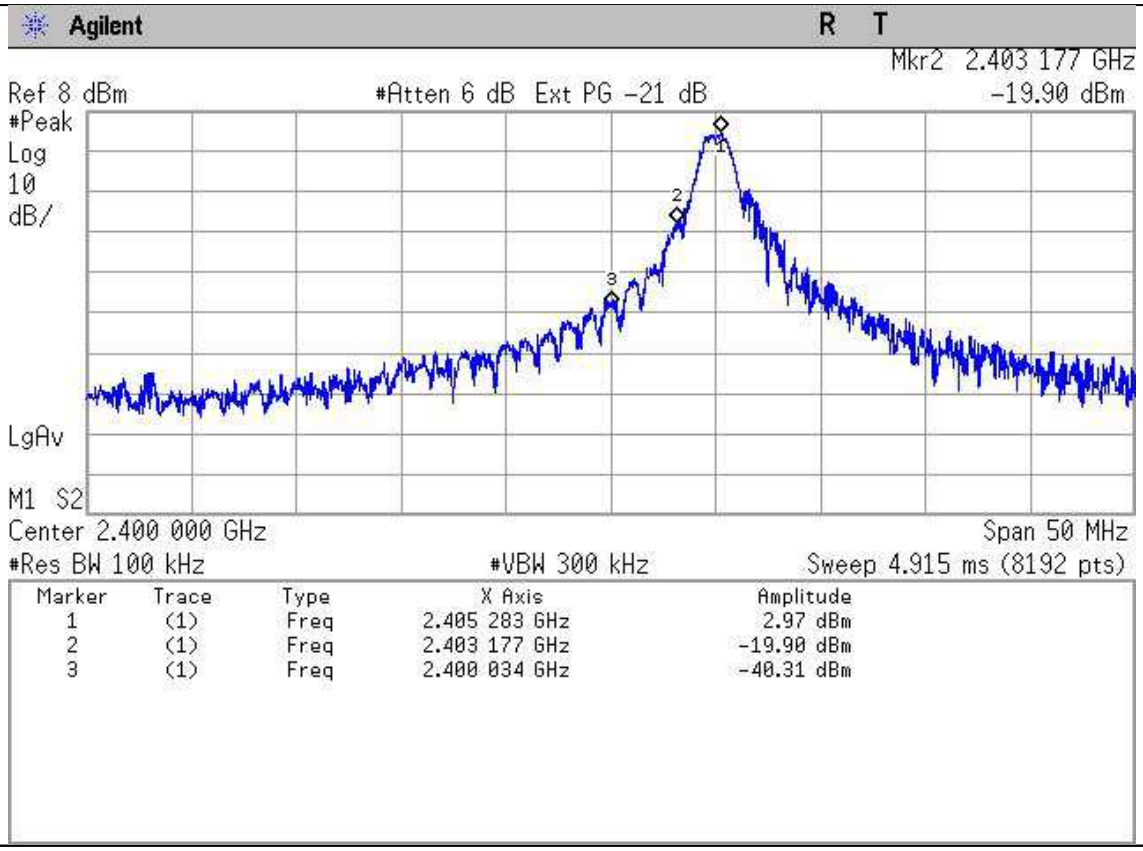
Results:

No non-compliance noted

The following figures show the results.

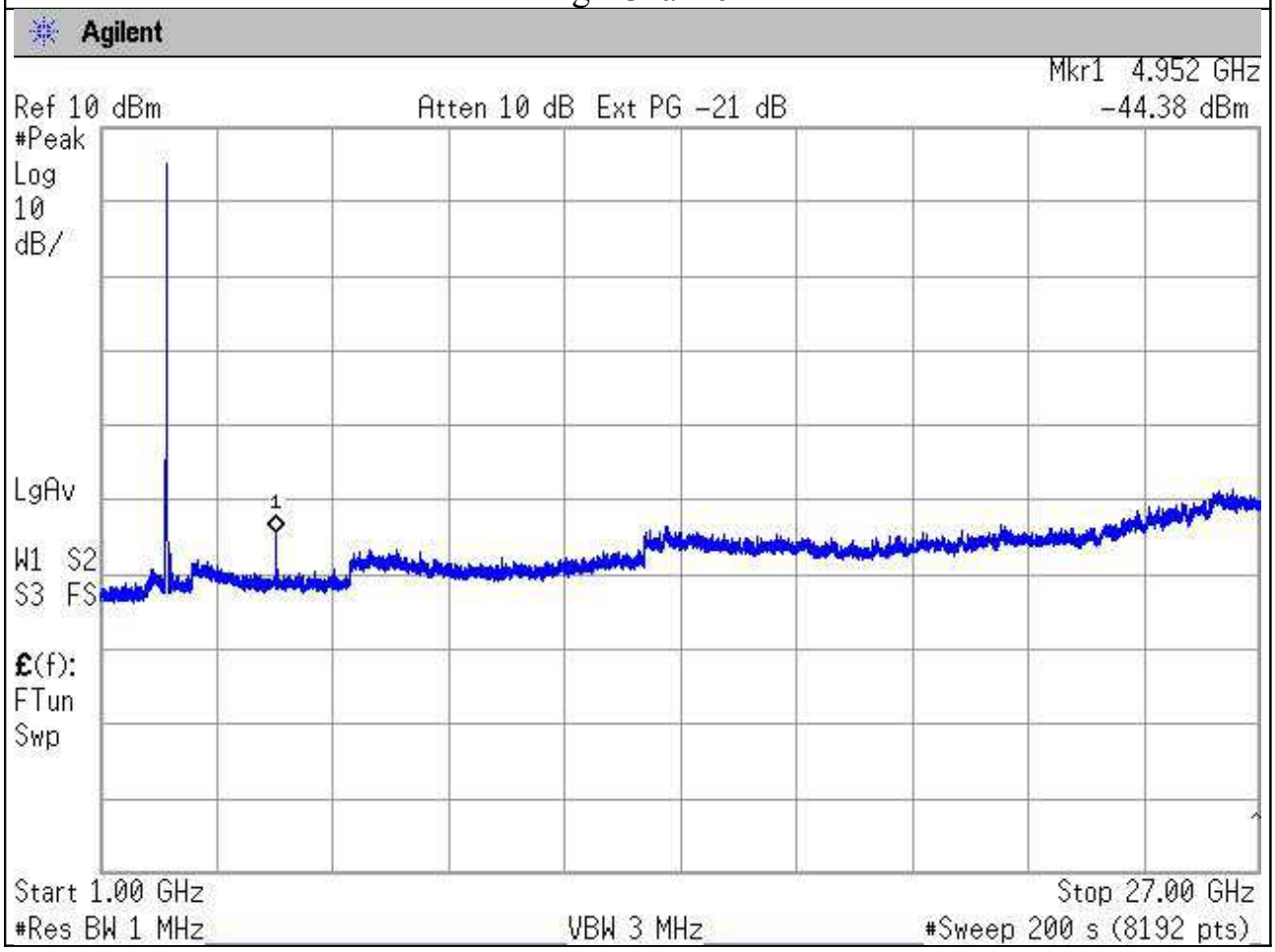
Conducted Spurious Emissions
Low Channel

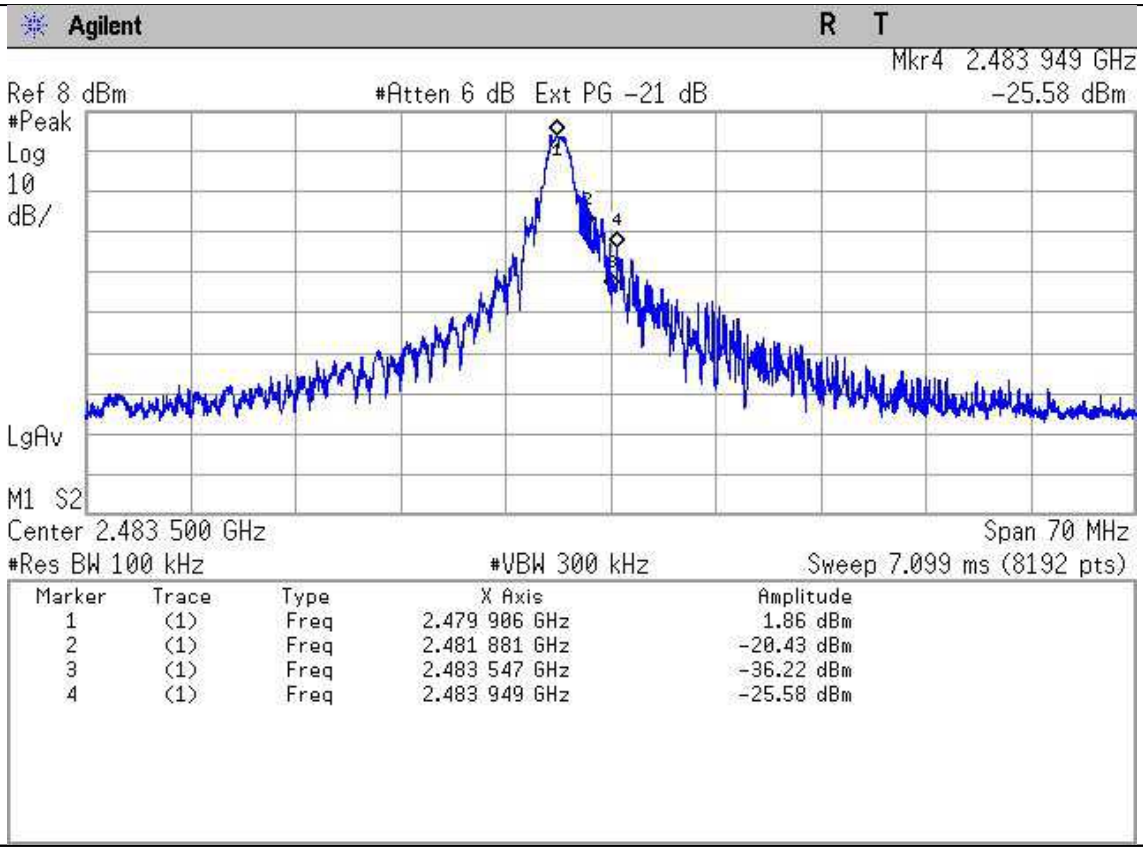




Note:

Conducted Spurious Emissions
High Channel




Agilent
R T
Mkr4 2.483 949 GHz
Ref 8 dBm
#Atten 6 dB Ext PG -21 dB
-25.58 dBm
#Peak
Log
10
dB/
LgAv
M1 S2
Center 2.483 500 GHz
Span 70 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 7.099 ms (8192 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.479 906 GHz 1.86 dBm
2 (1) Freq 2.481 881 GHz -20.43 dBm
3 (1) Freq 2.483 547 GHz -36.22 dBm
4 (1) Freq 2.483 949 GHz -25.58 dBm

Note:

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. DUE
EMI Receiver	Agilent	E4440A	01/2016

Test procedure: APR01

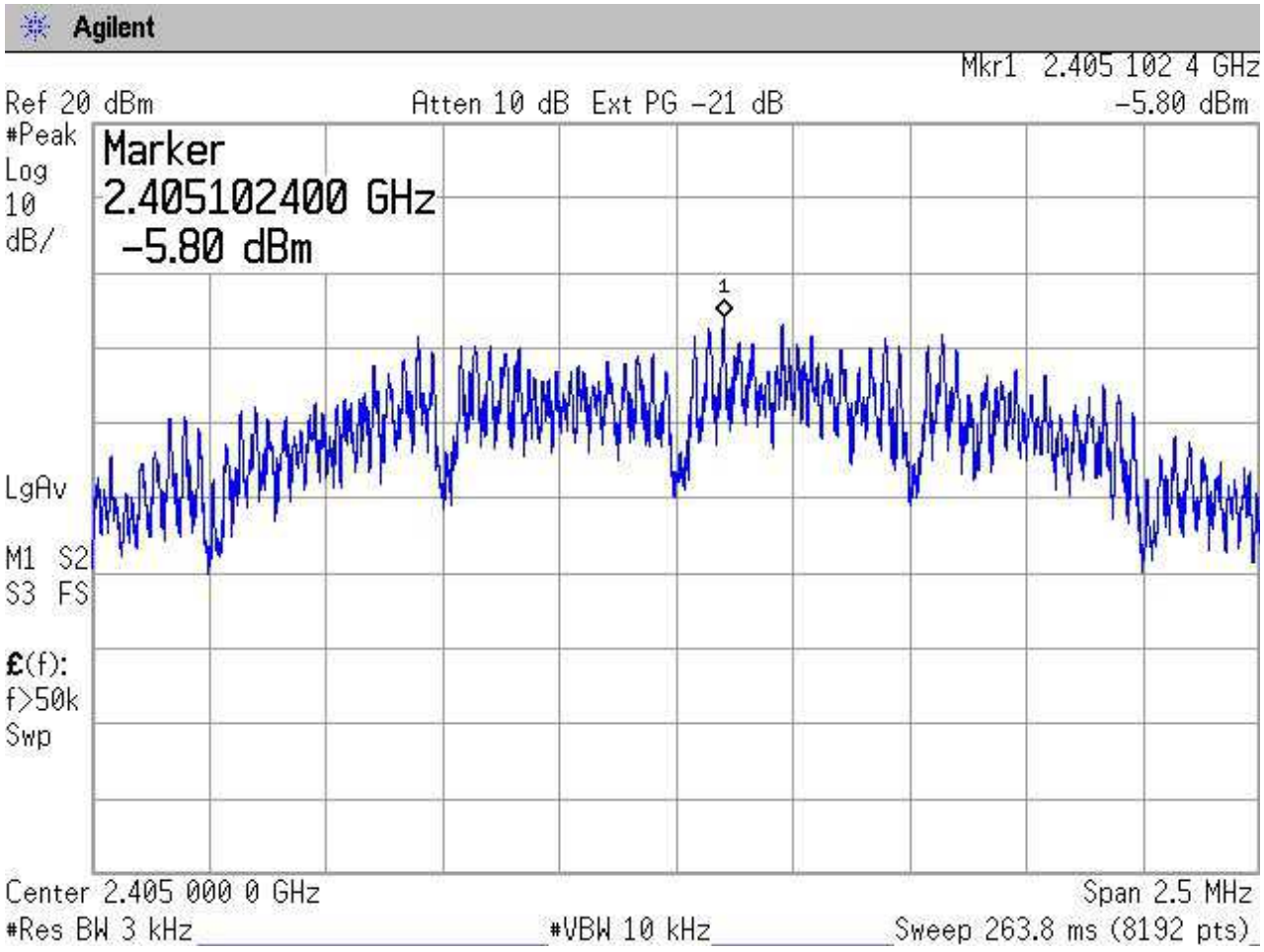
Test performed on low, middle and high channels and in the b,g,n protocols at maximum and minimum data rate for each protocol.

Results:

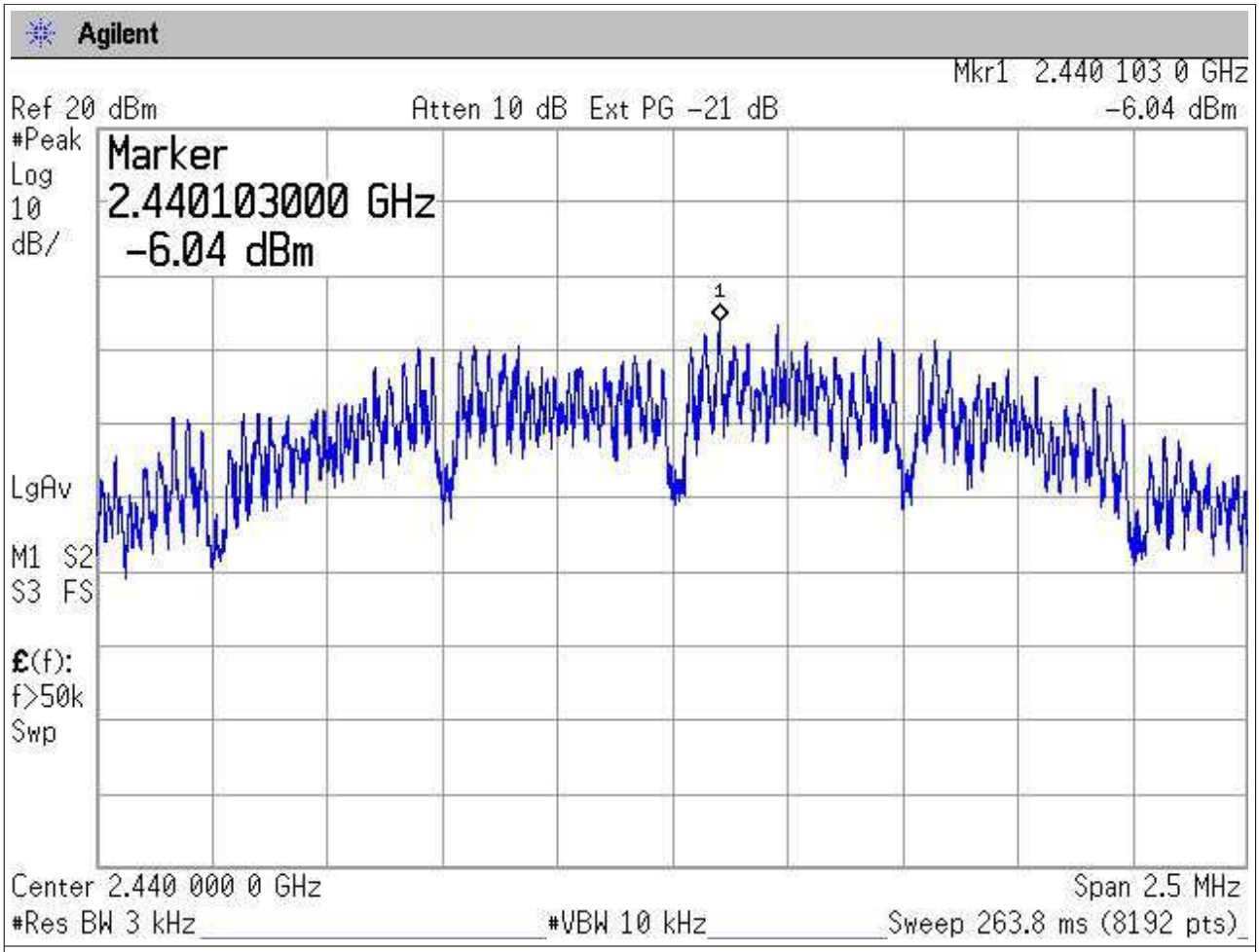
No non-compliance noted

Channel	*Frequency (MHz)*	*PPSD (dBm)*	*Limit (dBm)*	*Margin (dB)*
Low	2405	-5,8	8	13,8
Mid	2440	-6,04	8	14,04
High	2480	-6,26	8	14,26

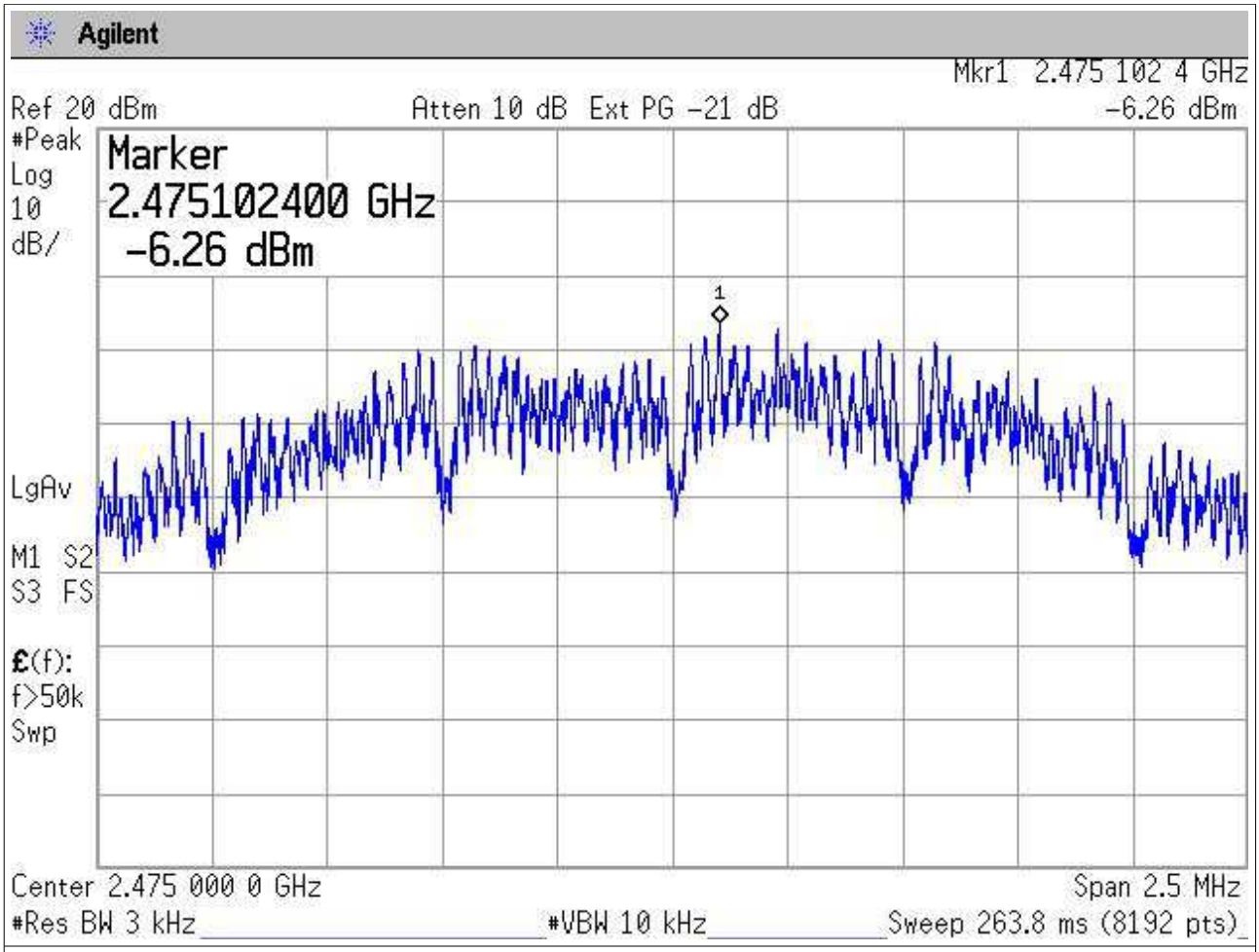
The following figures show the results


Agilent
Mkr1 2.405 102 4 GHz
Ref 20 dBm
Atten 10 dB Ext PG -21 dB
-5.80 dBm
#Peak
Log
10
dB/
Marker
2.405102400 GHz
-5.80 dBm
1
LgAv
M1 S2
S3 FS
£(f):
f>50k
Swp
Center 2.405 000 0 GHz
Span 2.5 MHz
#Res BW 3 kHz
#VBW 10 kHz
Sweep 263.8 ms (8192 pts)

LOW CHANNEL


Agilent
Mkr1 2.440 103 0 GHz
Ref 20 dBm
Atten 10 dB Ext PG -21 dB
-6.04 dBm
#Peak
Log
10
dB/
Marker
2.440103000 GHz
-6.04 dBm
LgAv
M1 S2
S3 FS
£(f):
f>50k
Swp
Center 2.440 000 0 GHz
Span 2.5 MHz
#Res BW 3 kHz
#VBW 10 kHz
Sweep 263.8 ms (8192 pts)

MID CHANNEL



HIGH CHANNEL

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

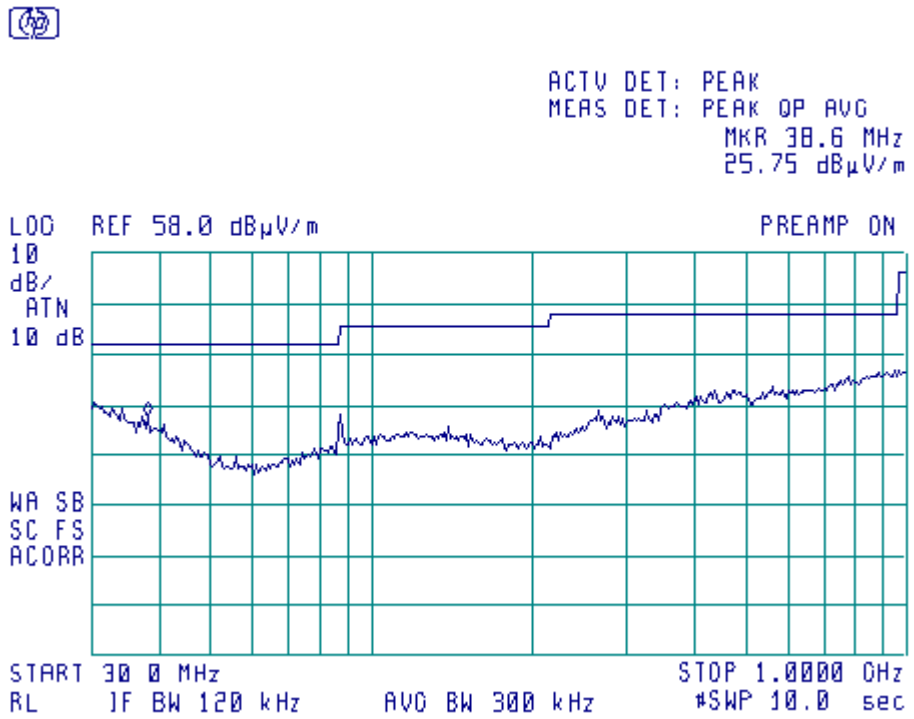
EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
EMI Receiver	HP	HP8546A	01/2016
EMI Receiver Filter Section	HP	HP85460A	01/2016
EMI Receiver	Agilent	E4440A	01/2016
EMI Receiver Filter Section	Agilent	N9039A	01/2016
Anechoic Chamber	Comtest	CSA01	01/2016
Horn Antenna (1-18 GHz)	EMCO	3115	01/2016
Loop Antenna	EMCO	6512	01/2016
Horn Antenna (18-26.5 GHz)	Alpha Ind. Inc.	100655A	01/2016
Bilog Antenna	Schaffner	CBL6112B	01/2016
Controller	Deisel	HD100	01/2016
Turn Table	Deisel	MA240	01/2016

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

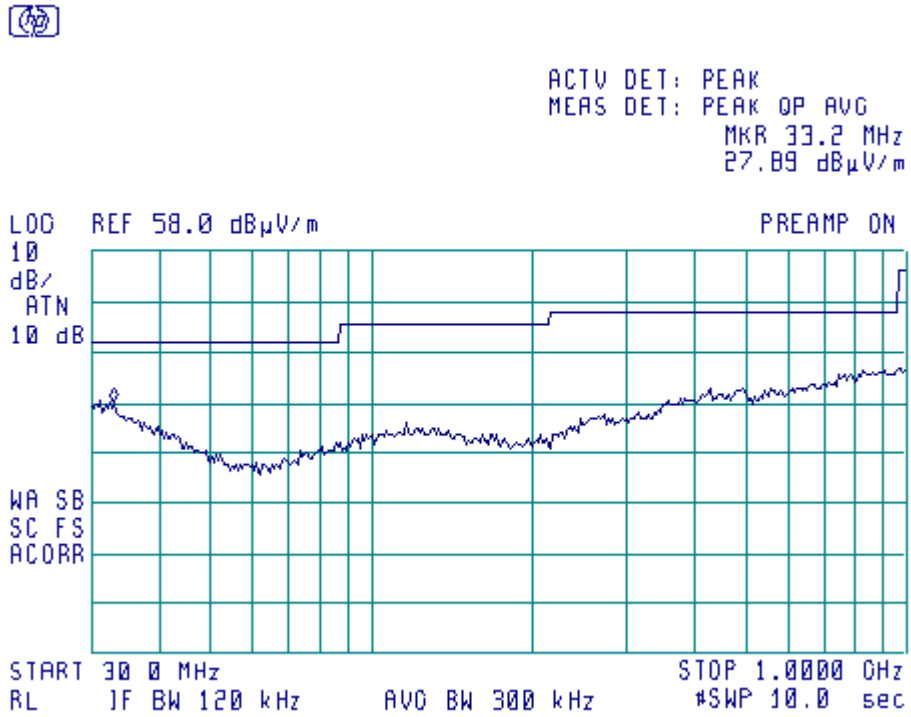
degrees, TT rotation is anticlockwise.
Antenna height respect to the mass plane is conventionally individuated with: MA=XXX where XXX indicates the height (always positive for e>100) expressed in cm.
Antenna horizontal polarisation is indicated by POL=H.
Antenna vertical polarisation is indicated by 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.



Notes: POL V

Record of the measurement of radiated emissions.

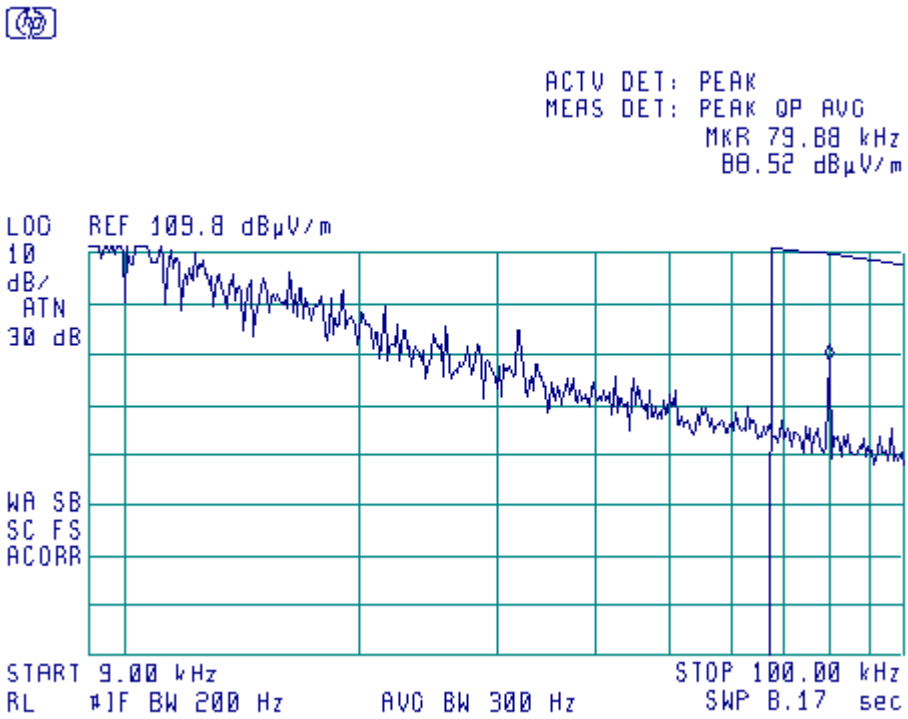
One of the maximum disturbance determined in the frequency range 30MHz – 1 GHz.



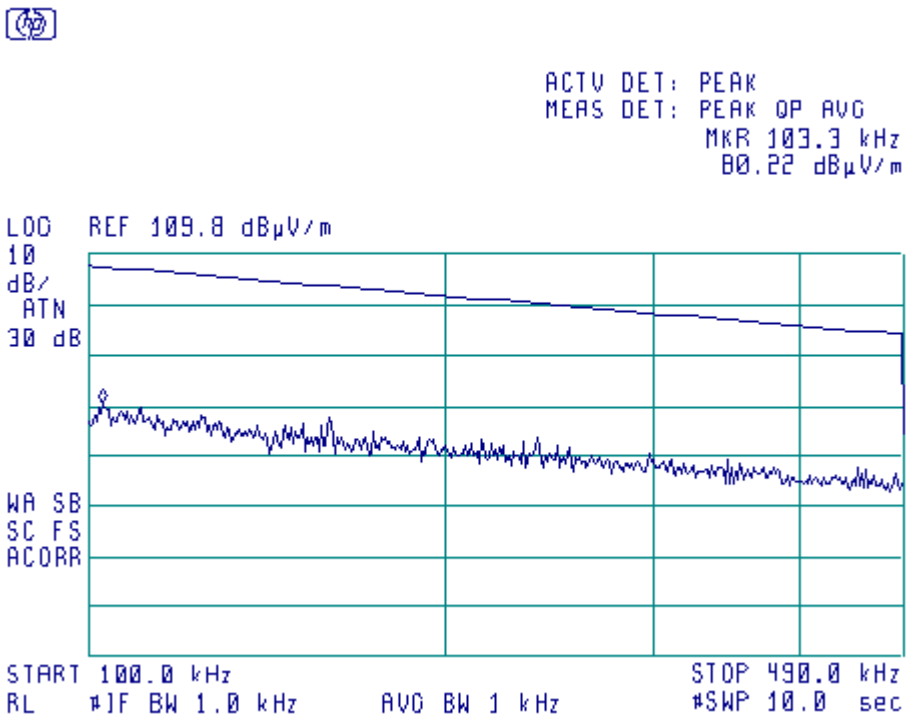
Notes:
POL H

Record of the measurement of radiated emissions.
One of the maximum disturbance determined in the frequency range 30MHz – 1 GHz.

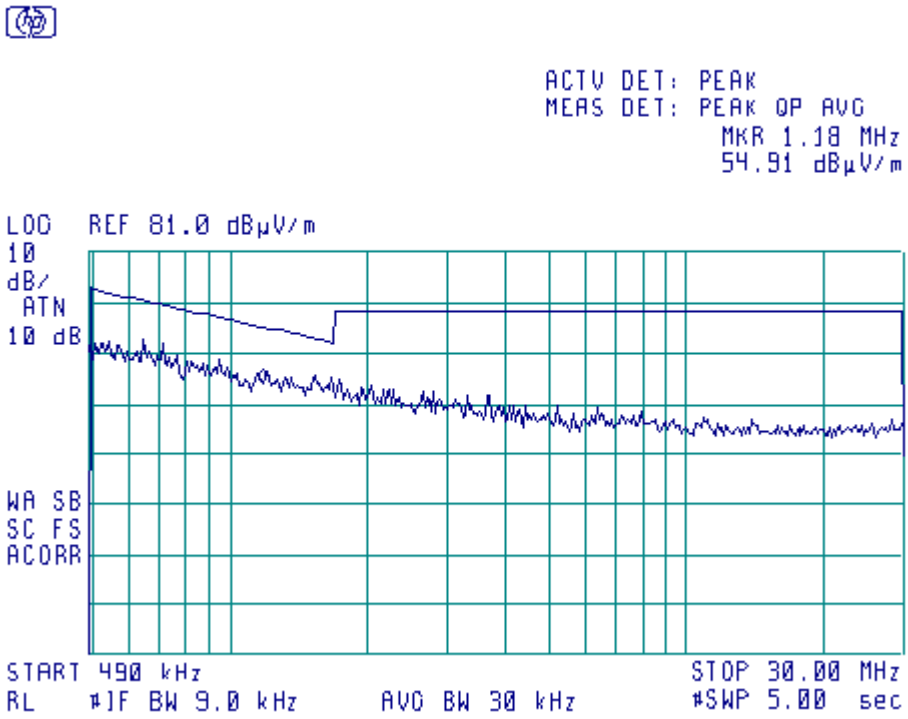
MAGNETIC FIELD EMISSIONS:



9 KHZ – 100 KHZ

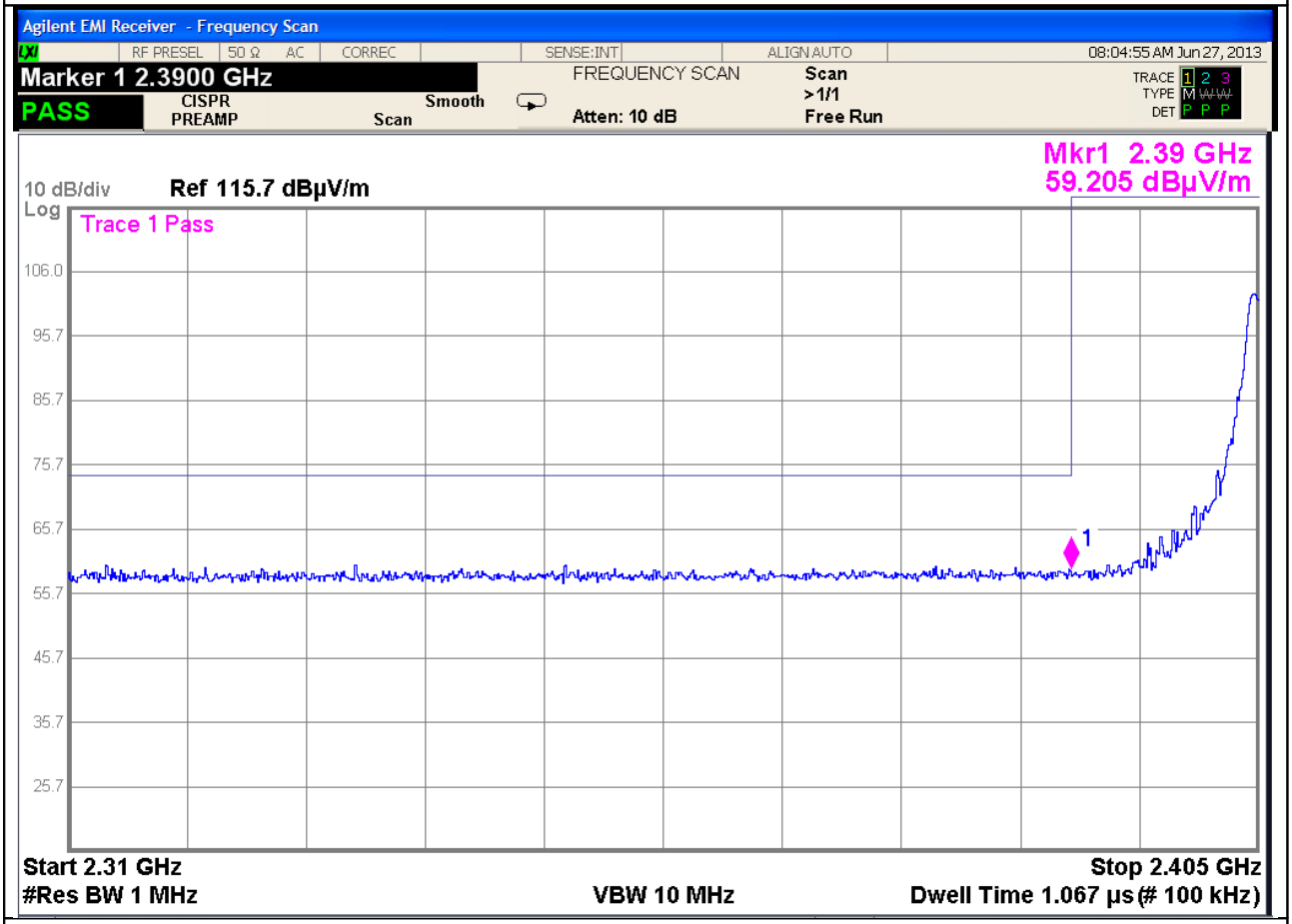


100 KHZ – 490 KHZ



490 κHz – 30 MHz

Restricted Band Edge Radiated Measurement
Low Channel

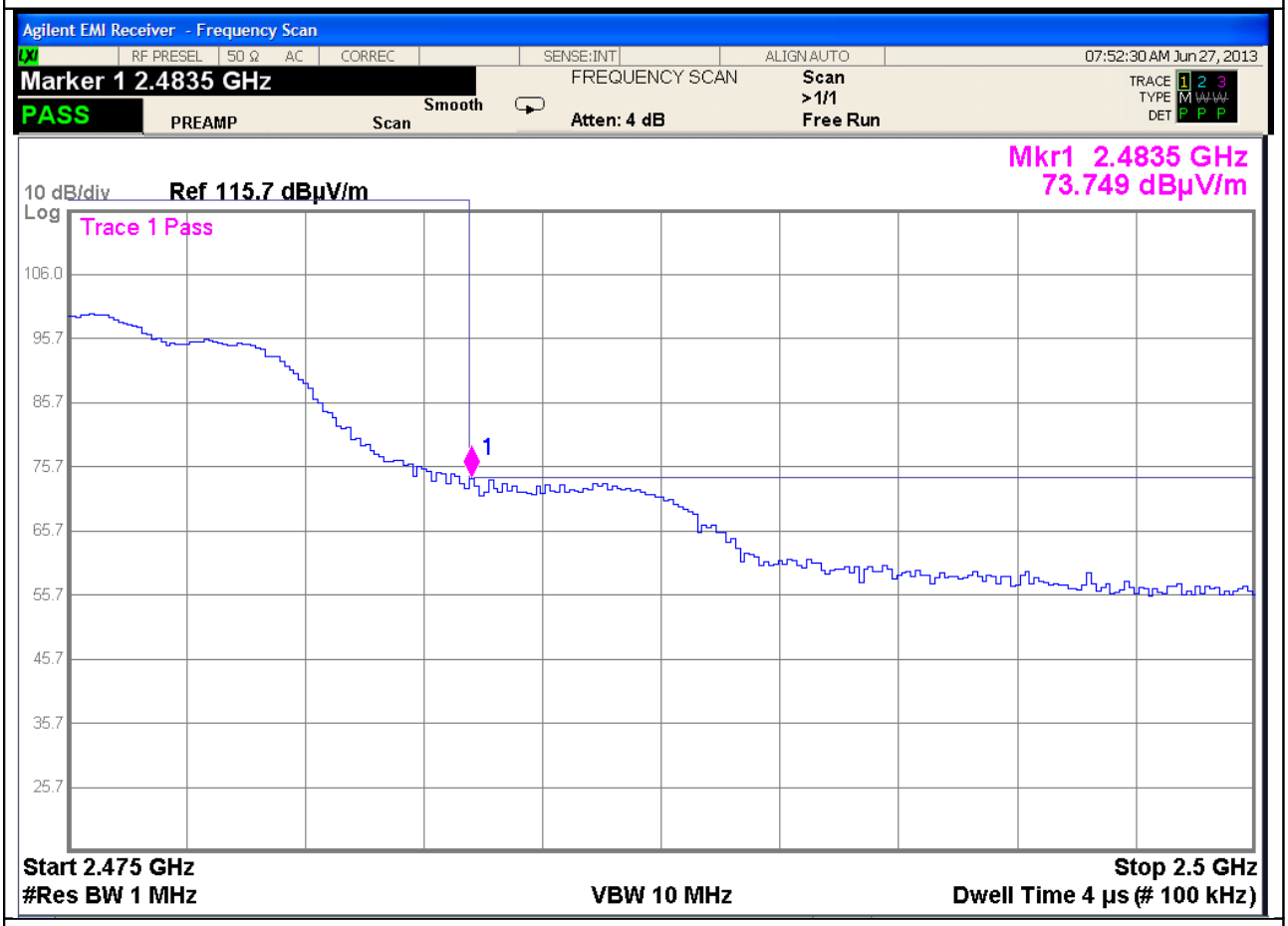


Note: Peak Measurement

Restricted Band Edge Radiated Measurement
Low Channel

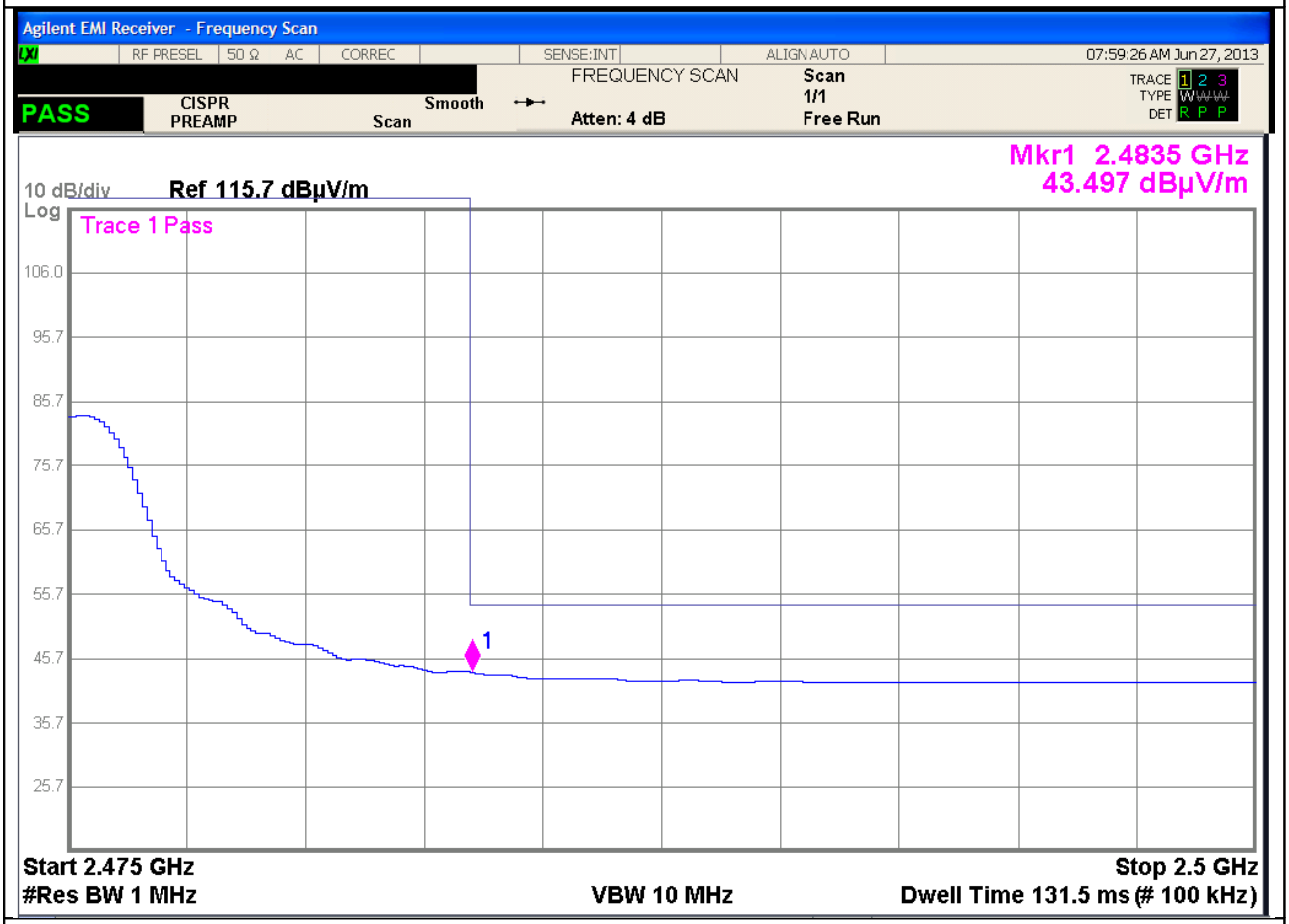
Note: AVG Measurement

Restricted Band Edge Radiated Measurement
High Channel



Note: Peak Measurement

Restricted Band Edge Radiated Measurement
High Channel



Note: AVG Measurement

RADIATED SPURIOUS EMISSIONS

Low Channel

F GHz	Polarization	Peak dBuV/m	Avg dBuV/m	Limit Peak	Limit Avg
4,824	H	< 60	< 40	74,0	54,0
4,824	V	< 60	< 40	74,0	54,0
7,236	H	< 60	< 40	74,0	54,0
7,236	V	< 60	< 40	74,0	54,0
9,648	H	< 60	< 40	74,0	54,0
9,648	V	< 60	< 40	74,0	54,0

NO OTHER EMISSIONS WERE DETECTED ABOVE SYSTEM NOISE FLOOR

Mid Channel					
F GHz	Polarization	Peak dBuV/m	Avg dBuV/m	Limit Peak	Limit Avg
4,874	H	< 60	< 40	74,0	54,0
4,824	V	< 60	< 40	74,0	54,0
7,311	H	< 60	< 40	74,0	54,0
7,311	V	< 60	< 40	74,0	54,0
9,748	H	< 60	< 40	74,0	54,0
9,748	V	< 60	< 40	74,0	54,0
NO OTHER EMISSIONS WERE DETECTED ABOVE SYSTEM NOISE FLOORS					

High Channel					
F GHz	Polarization	Peak dBuV/m	Avg dBuV/m	Limit Peak	Limit Avg
4,924	H	< 60	< 40	74,0	54,0
4,924	V	< 60	< 40	74,0	54,0
7,386	H	< 60	< 40	74,0	54,0
7,386	V	< 60	< 40	74,0	54,0
9,848	H	< 60	< 40	74,0	54,0
9,848	V	< 60	< 40	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 (erp) mW	Power Density at 20cm mW/cm^2	Remark
1	4,6	0,0014	-

(*) OET Bulletin 65

10. PHOTO

Fig. 10.1

Radiated Emissions Test Set-up

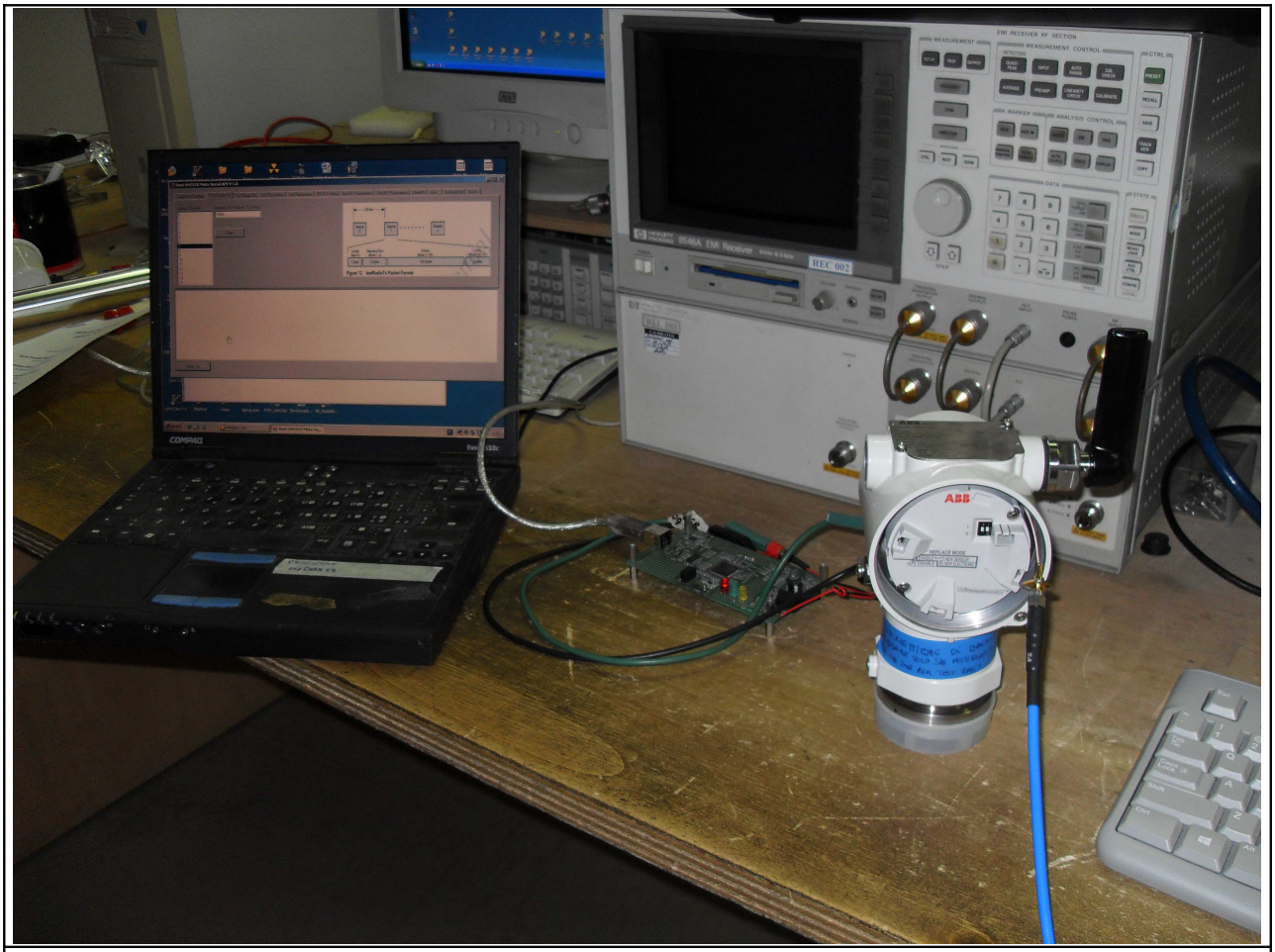
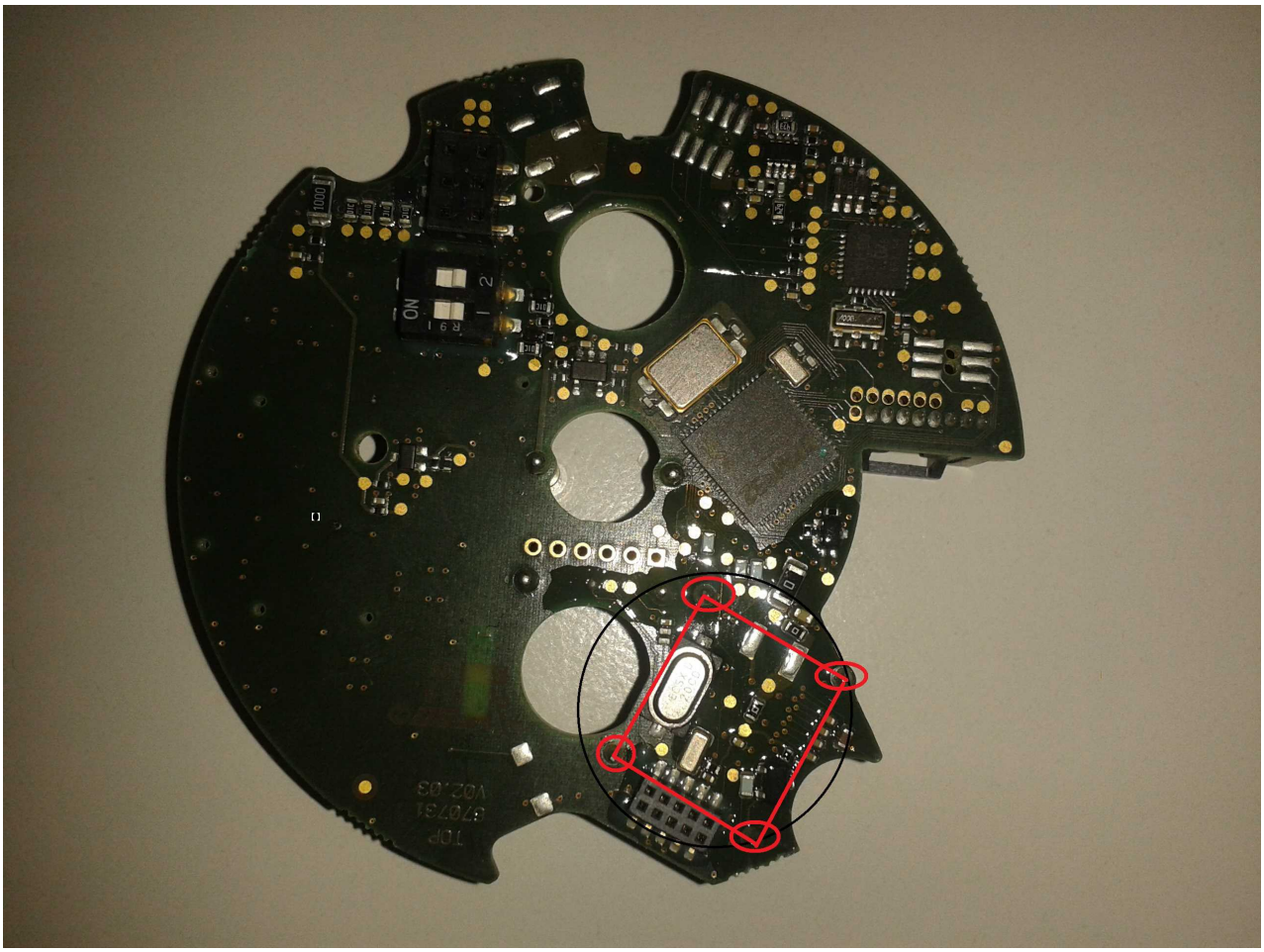


Fig. 10.2

Antenna Port Conducted Emissions Test Set-up



TX module Photo