

		CE MARKING ELECTROMAGNETIC COMPATIBILITY ELECTRICAL SAFETY LASER SPECTROSCOPY ENVIRONMENTAL PHYSICS	G.S.D. S.r.l. Certified in accordance with UNI EN ISO 9001:2008 by TÜV Rheinland Italia S.r.l. Certificate N. 39 00 1850509
G.S.D. Srl PISA - Italy	Test Report n. FCC-17337		Rev. 00
Manufacturer	CAEN RFID S.r.l.		
Address	Via Vetraia, 11 55049 Viareggio (LU) Italy		
Test Family Name	R1170IU		
Testing Laboratory Name	G.S.D. S.r.l.		
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FCC Listed: Registration Number: 424037			
Location and Date of Issue	Pisa, 2017 May 17		
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1. MANUFACTURER AND EUT IDENTIFICATION¹	
Manufacturer	CAEN RFID S.r.l..
Address	Via Vetraia, 11 55049 Viareggio (LU) Italy
Test Family Name	R1170IU
Date of reception	2017 April 11
Sampling	Laboratory sample for certification
Test Item Description	RFID Device
Nominal Input Voltage	5 Vdc (USB)
FCC ID	UVECAENRFID017

¹A detailed documentation is preserved in the internal fascicle.

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*Fig. 1.1
Equipment 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>
Emissions: Conducted and Radiated – Section 15.207 and 15.209	FCC Rules ad Regulations, Title 47 Part 15 – Sub part B ANSI C63.4 2014 – 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
Operation within the band 902-928 MHz: Alternative Test Procedures 15.247 (b) and (c) , and (a) Bandwidth and average time of occupancy, Band Edge 15.247 (d)	FCC Rules ad Regulations, Title 47 Part 15 – Sub part C DA 00-705 (30 March 2000) – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems ANSI C63.4 2014 – 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
Maximum Permissible Exposure	OET Bulletin 65 Evaluating Compliance with FCC Guidelines for Human Exposure to Radio-Frequency Electromagnetic Fields FCC Rules ad Regulations, Title 47 Part 15 – Sub part B DA 00-705 (30 March 2010) – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

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3. RESULT, CONDITION, MEASUREMENT UNCERTAINTY

Summary of Test Results

<i>TEST</i>	<i>RESULT</i>
Emissions: conducted Section 15.207	Pass
Emissions: radiated Section 15.209	Pass
Bandwidth and Average Time of Occupancy Section 15.247 (a)	Pass
Operation within the band 902-928 MHz: Section 15.247 (b) and (c)	Pass
Band Edge Section 15.247 (d)	Pass

Measurement uncertainty

<i>TEST</i>	<i>EXPANDED UNCERTAINTY</i>
Conducted Emission – 50Ω/50μH (150 kHz - 30 MHz)	± 3.5 dB
Radiated Emission – (Semianechoic Room) (30 MHz - 18 GHz)	± 4.7 dB

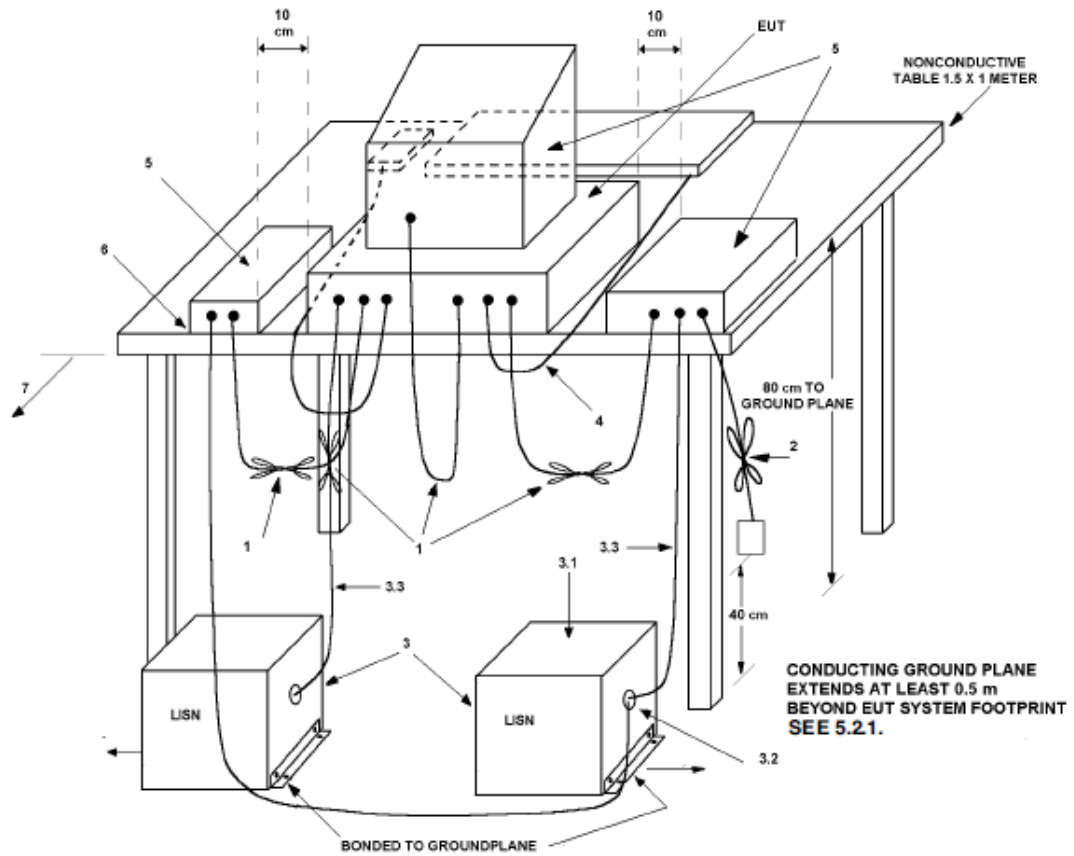
Climatic Conditions

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

Extensions

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

Modulations:
PR_ASK 40 kHz



Conducted and Radiated EUT Test Set-up example (ANSI C63.4 2014)

4. RADIATED EMISSIONS

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

FREQUENCY RANGE (MHz)	Field Strength QUASI-PEAK LIMITS [dB (μV/m)]
30 – 88	40
88 – 216	43.5
216 – 960	46
Above 960	54

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
MXE EMI Receiver	Agilent	N9038A	01/2018
Anechoic Chamber	Comtest	CSA01	01/2018
Bilog Antenna	Schaffner	CBL6112B	01/2018
Horn Antenna	EMCO	3115	01/2018
Horn Antenna	Alpha Industries	61932500	01/2018
Loop Antenna	ETS Lindgren	6215	01/2018
Controller	Deisel	HD100	01/2018
Turn Table	Deisel	MA240	01/2018
LISN	GSD	NTW06	01/2018

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 d > 100) expressed in cm.

Antenna horizontal polarisation is indicated by POL=H.

Antenna vertical polarisation is indicated by POL=V.

EUT was tested in the three ortogonal planes.

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.

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Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

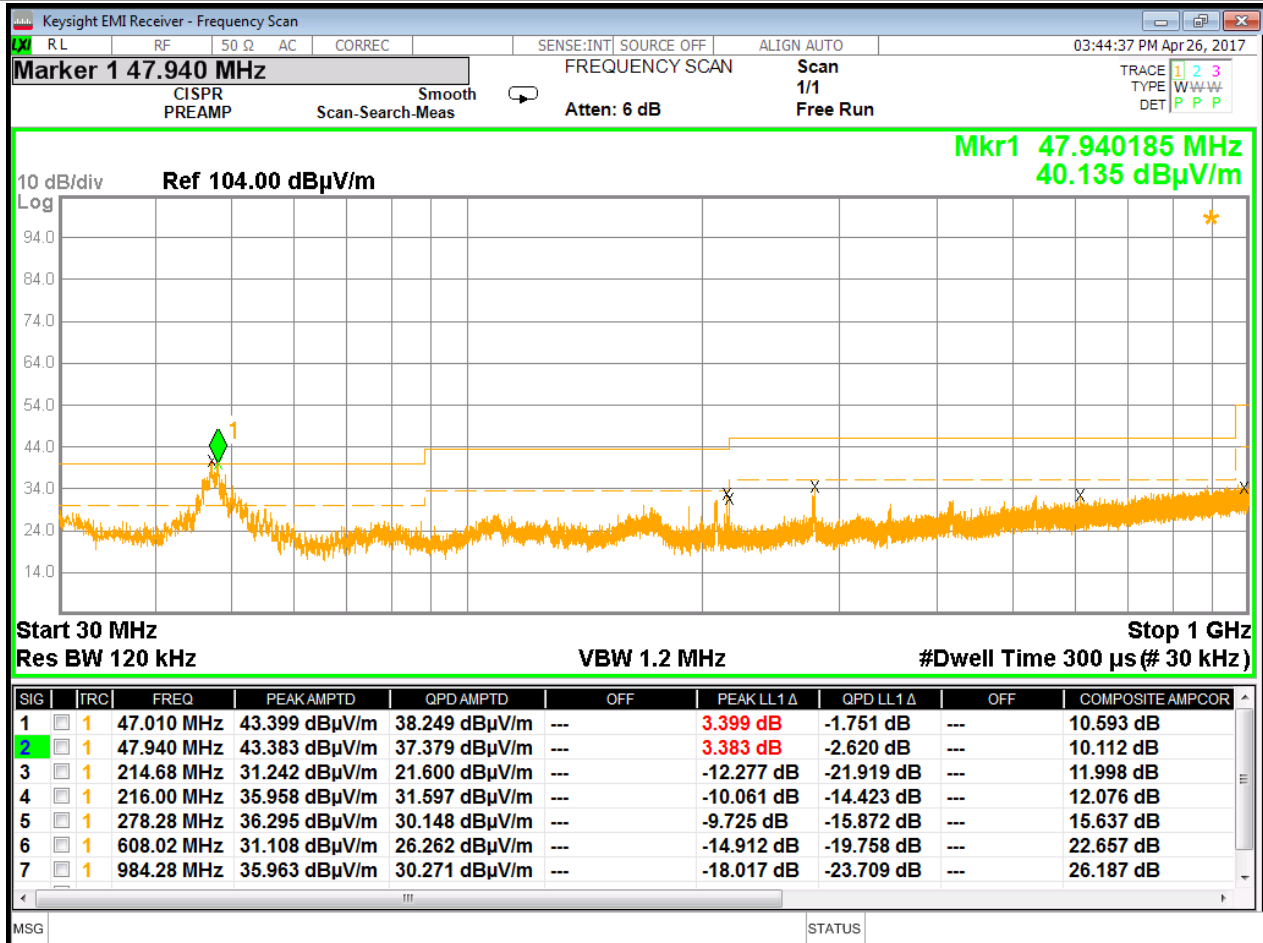


Fig. 4.1 - standby

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 30 – 1000 MHz, Pol. V.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

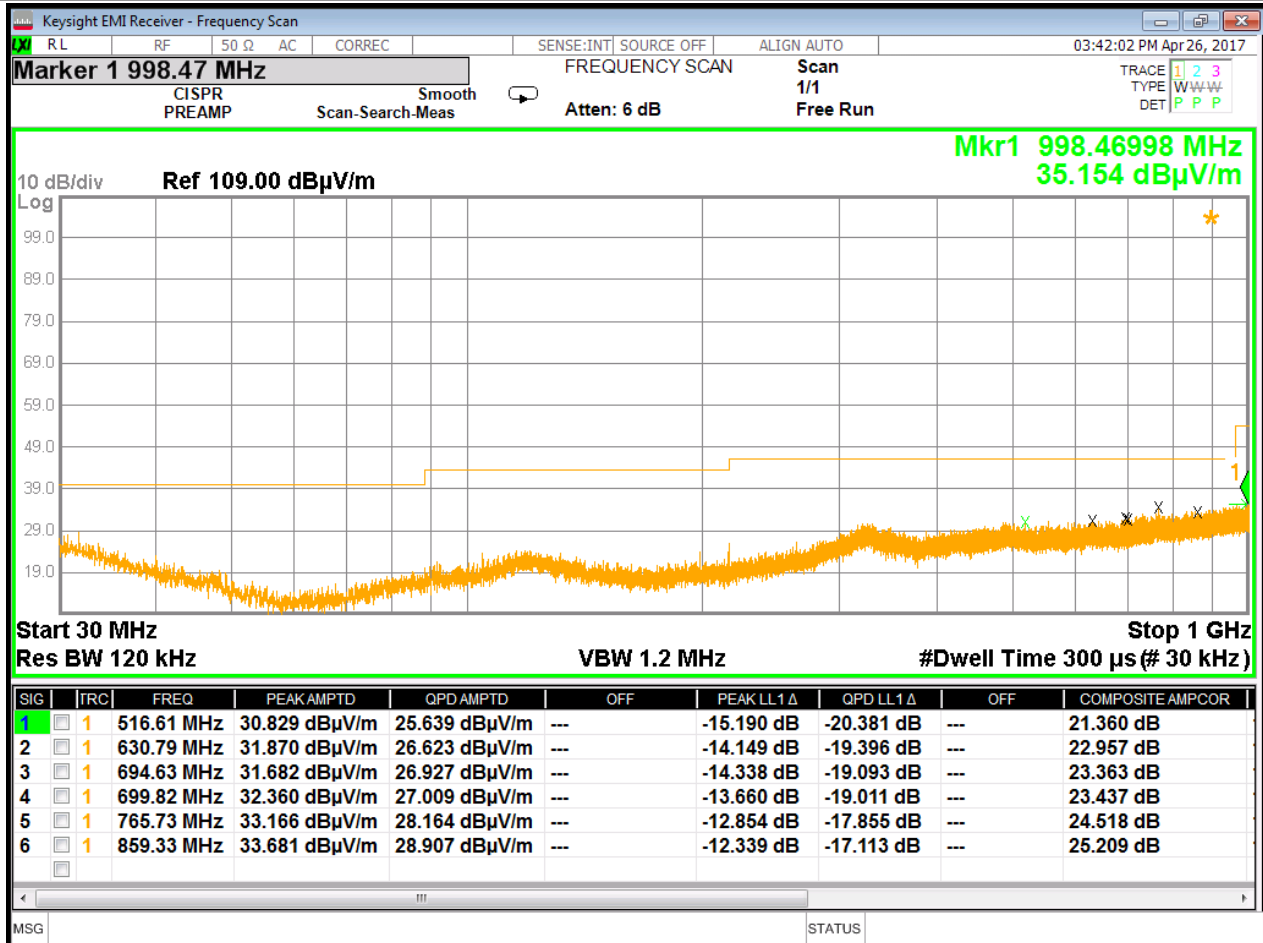


Fig. 4.2 - standby

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 30 – 1000 MHz, Pol. H.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

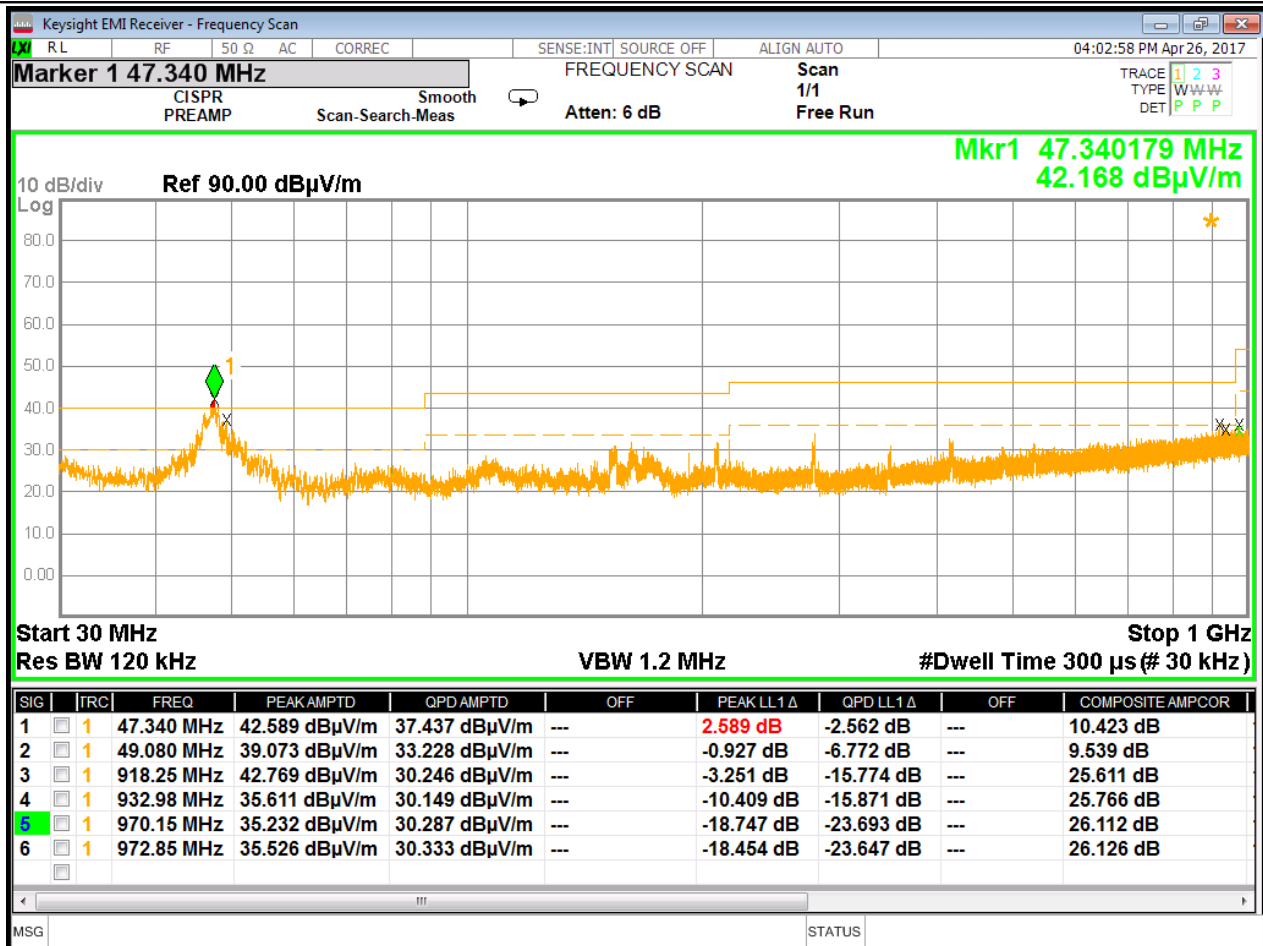


Fig. 4.3

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 30 – 1000 MHz, Pol. V.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

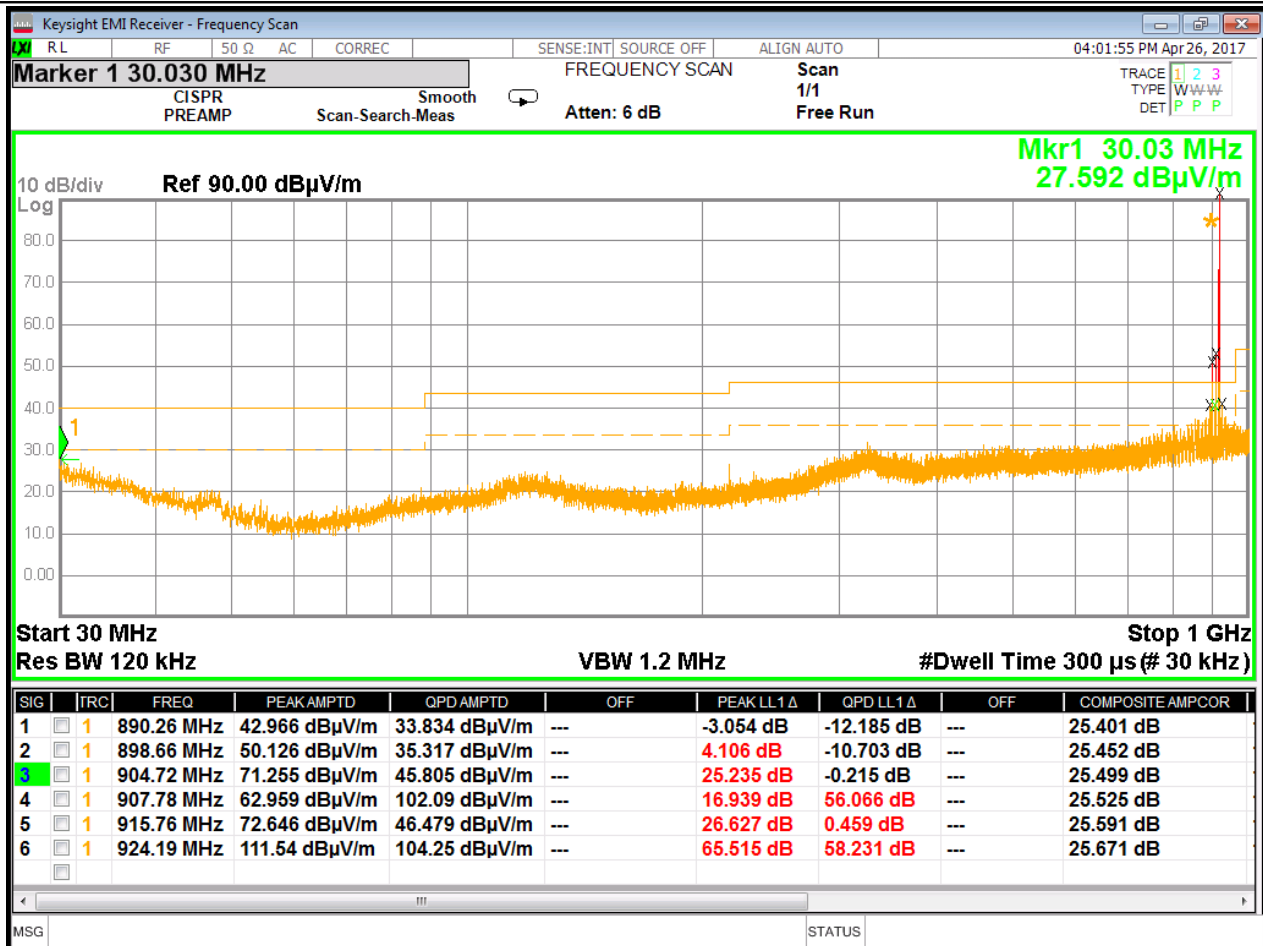


Fig. 4.4

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 30 – 1000 MHz, Pol. H.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

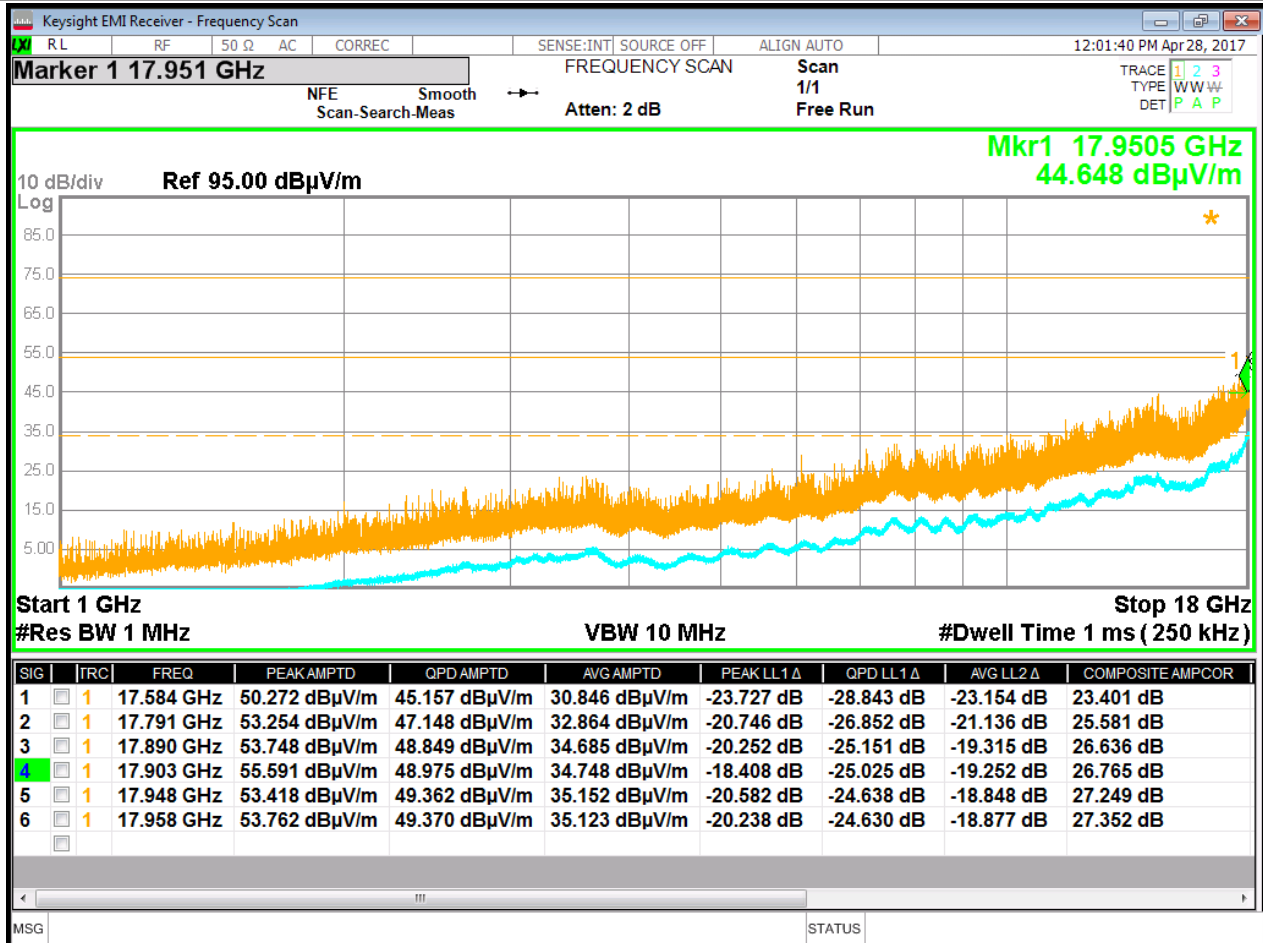


Fig. 4.5 - standby

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 1GHz – 10 GHz, Pol. V.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

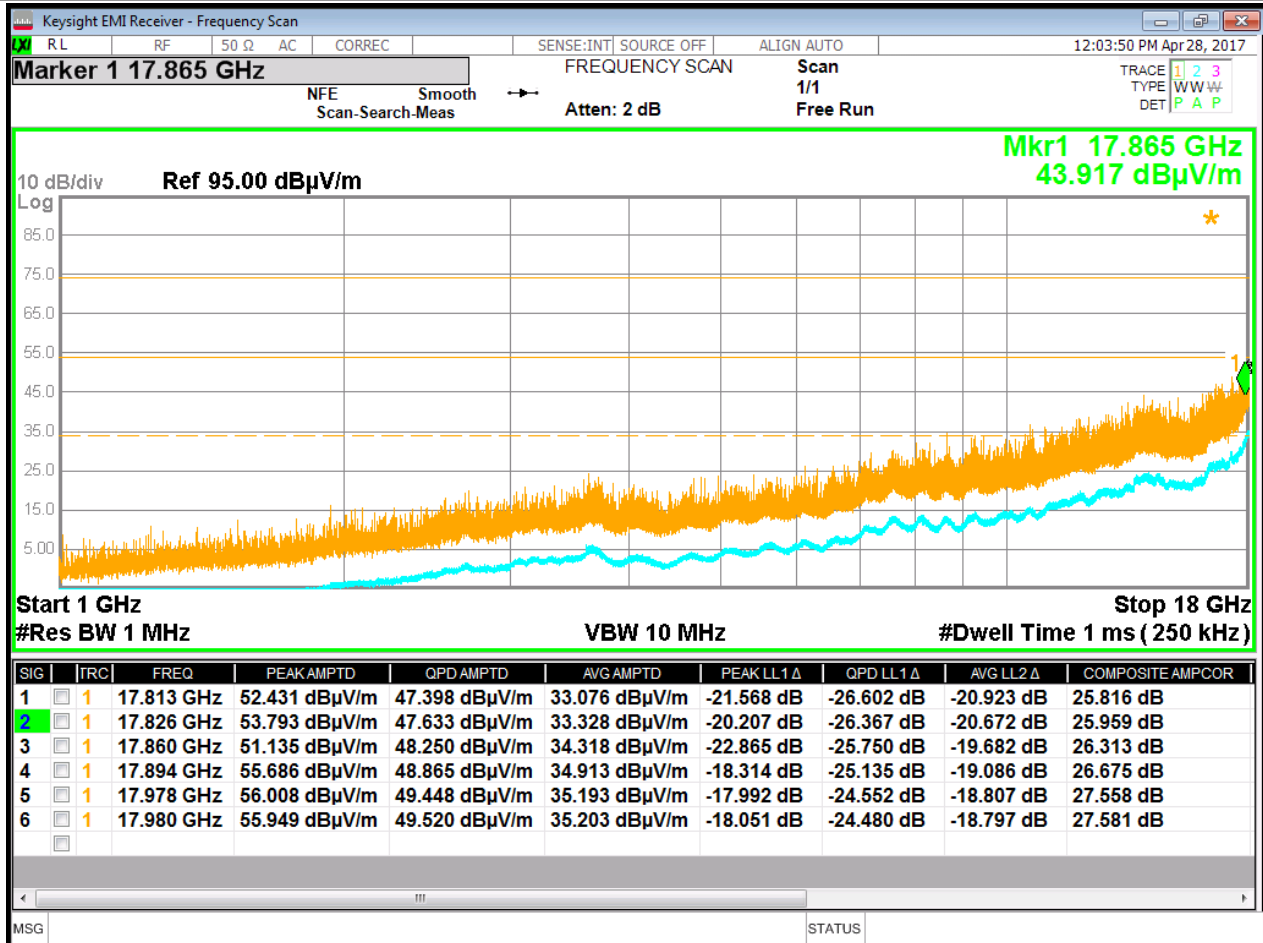


Fig. 4.6 - standby

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 1GHz – 10 GHz, Pol. H.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

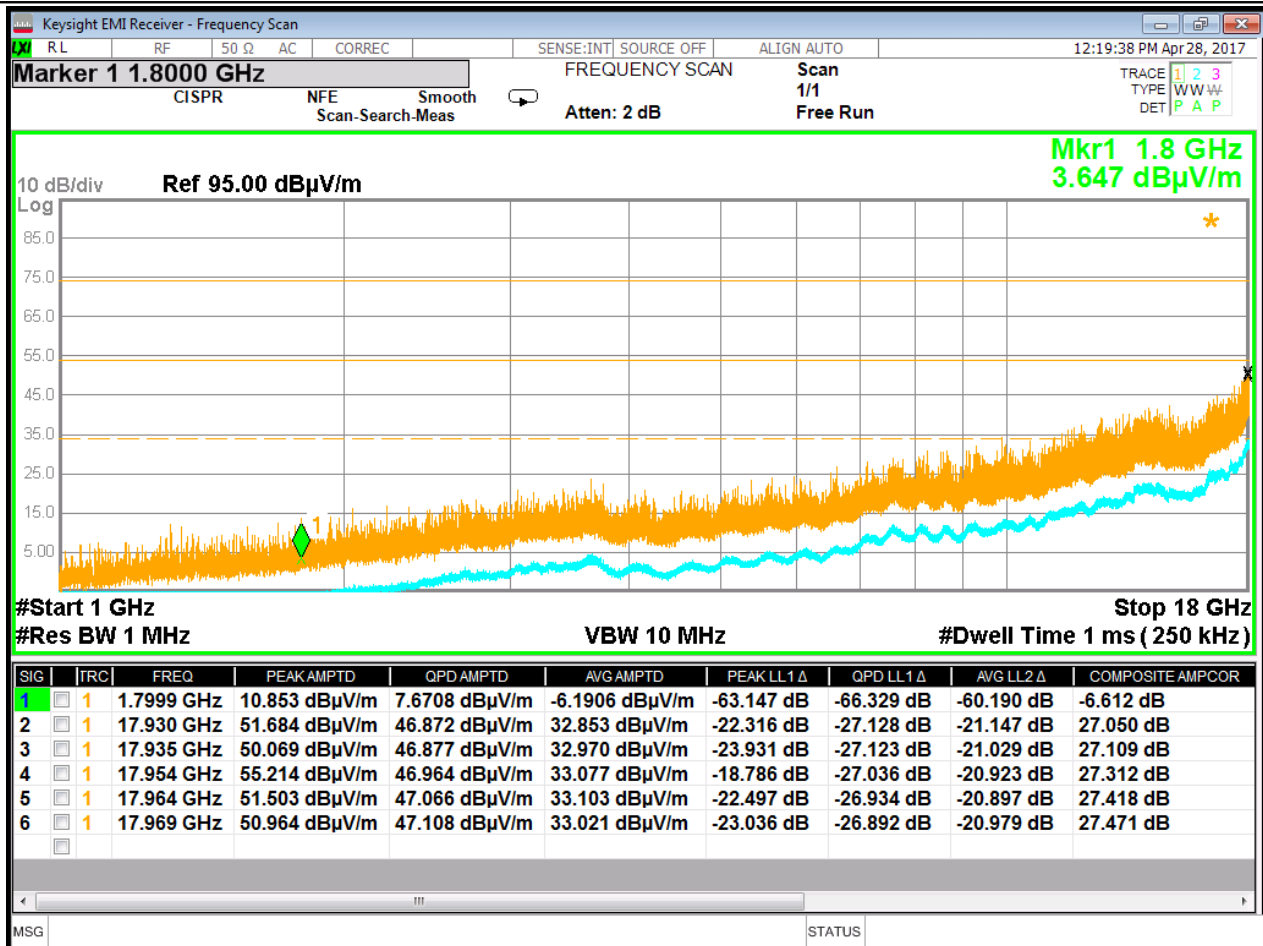


Fig. 4.7

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 1GHz – 10 GHz, Pol. V.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

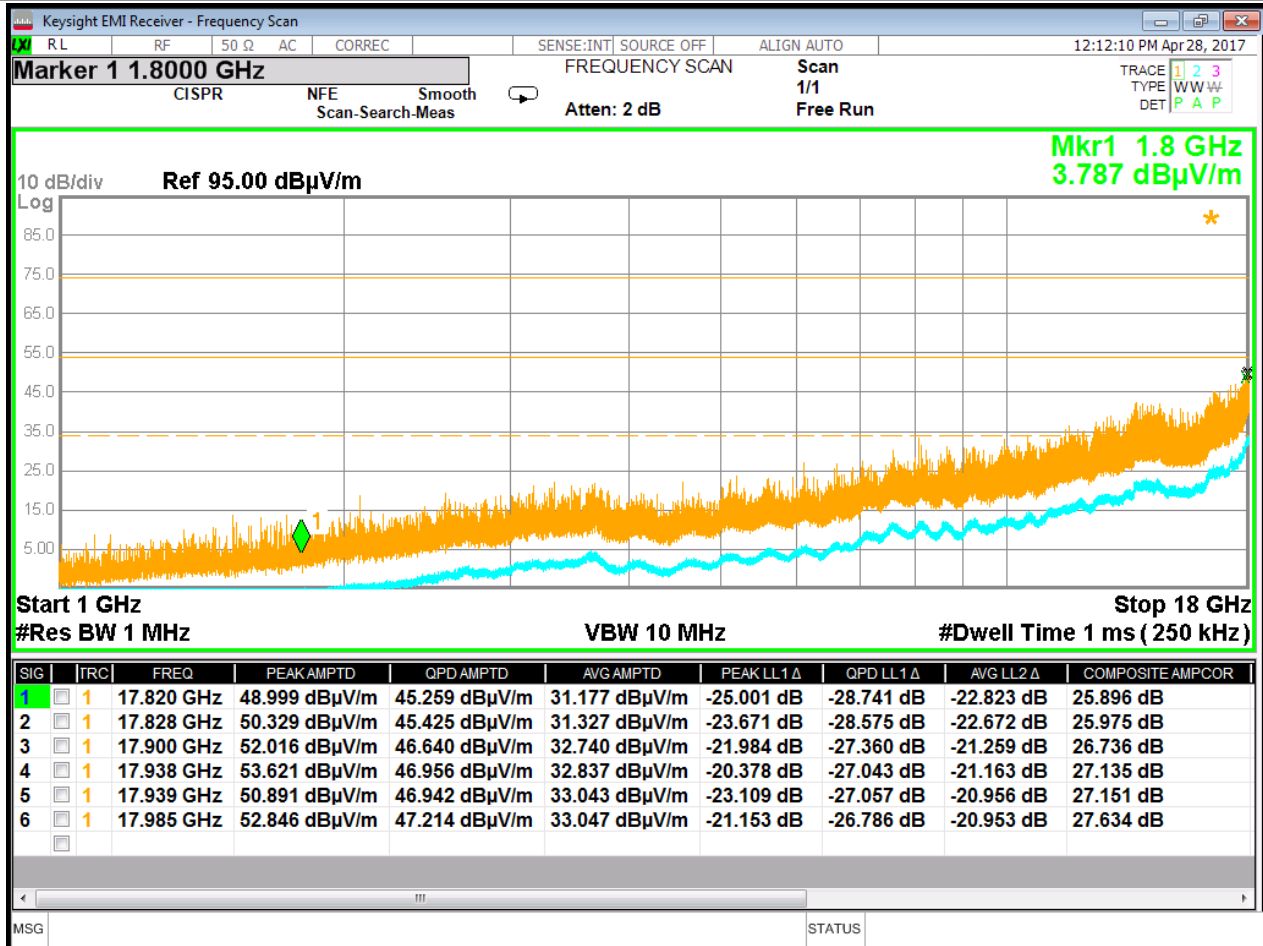


Fig. 4.8

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 1GHz – 10 GHz, Pol. H.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

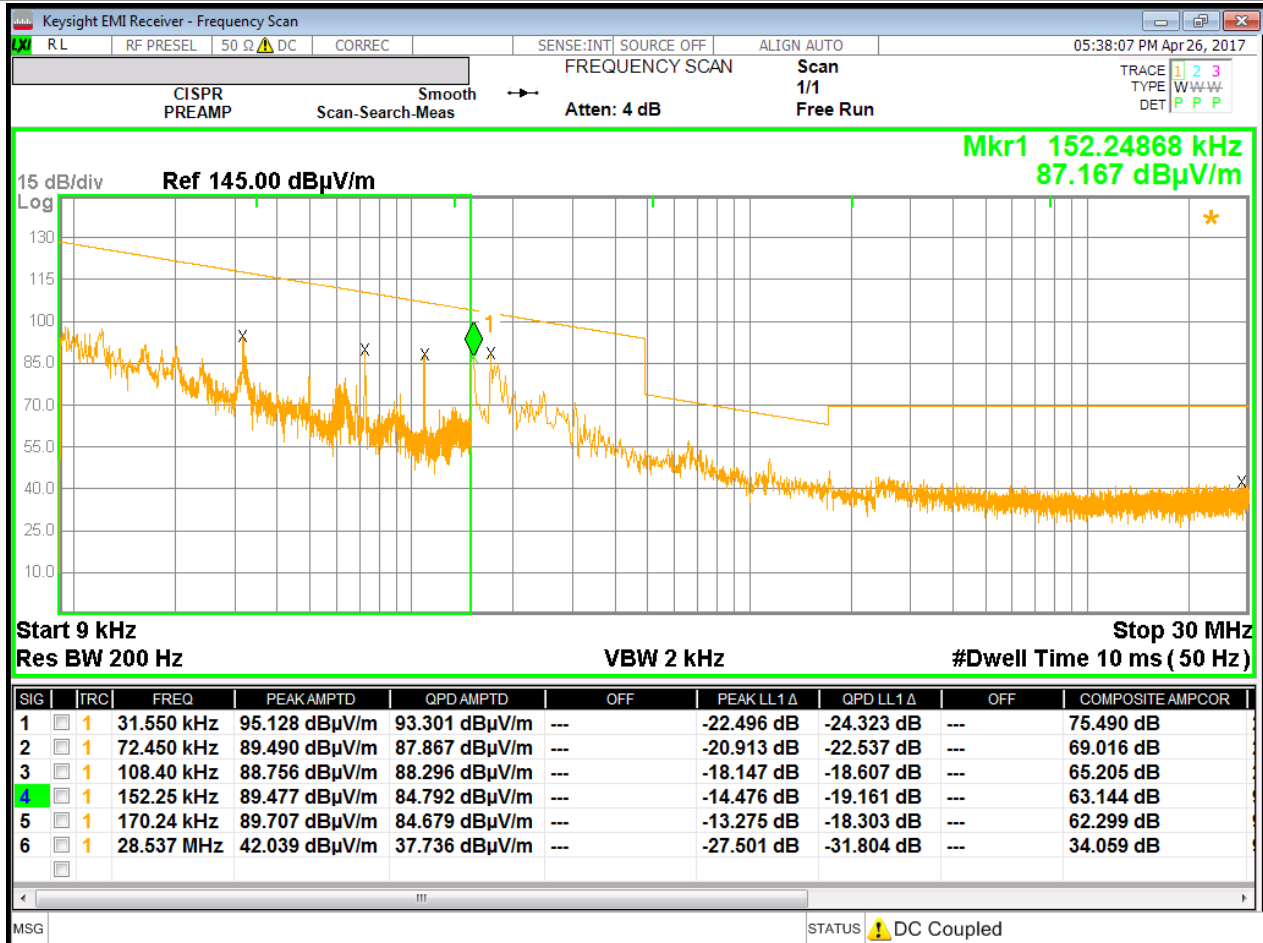


Fig. 4.9 - standby

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 0.009 – 30 MHz, Pol. Parallel.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

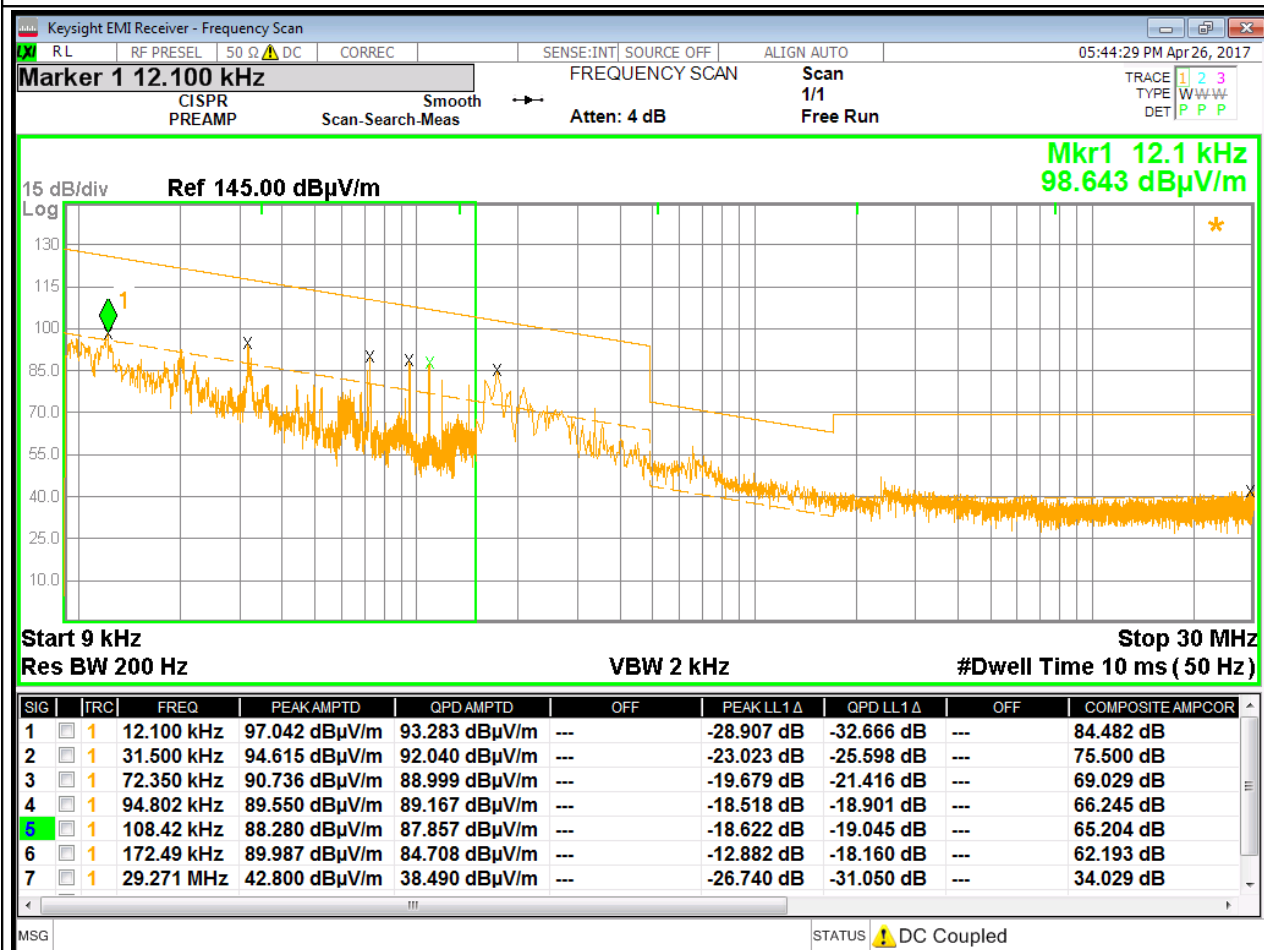


Fig. 4.10 - standby

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 0.009 – 30 MHz, Pol. Orthogonal.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

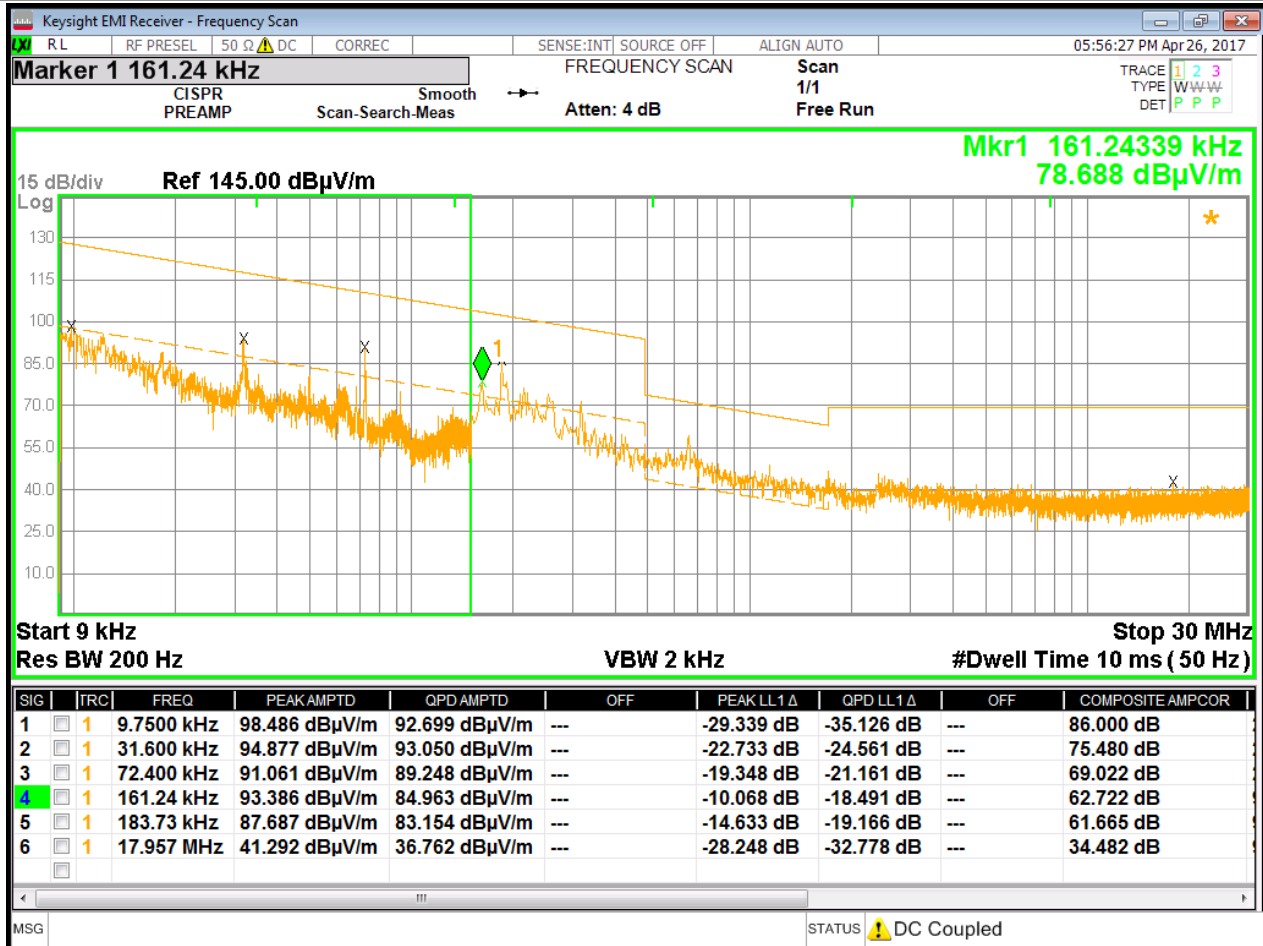


Fig. 4.11

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 0.009 – 30 MHz, Pol. Parallel.

Job Number FCC-17337
 Test Name Radiated Emissions
 EUT Name CAEN RFID S.r.l. - R1170IU

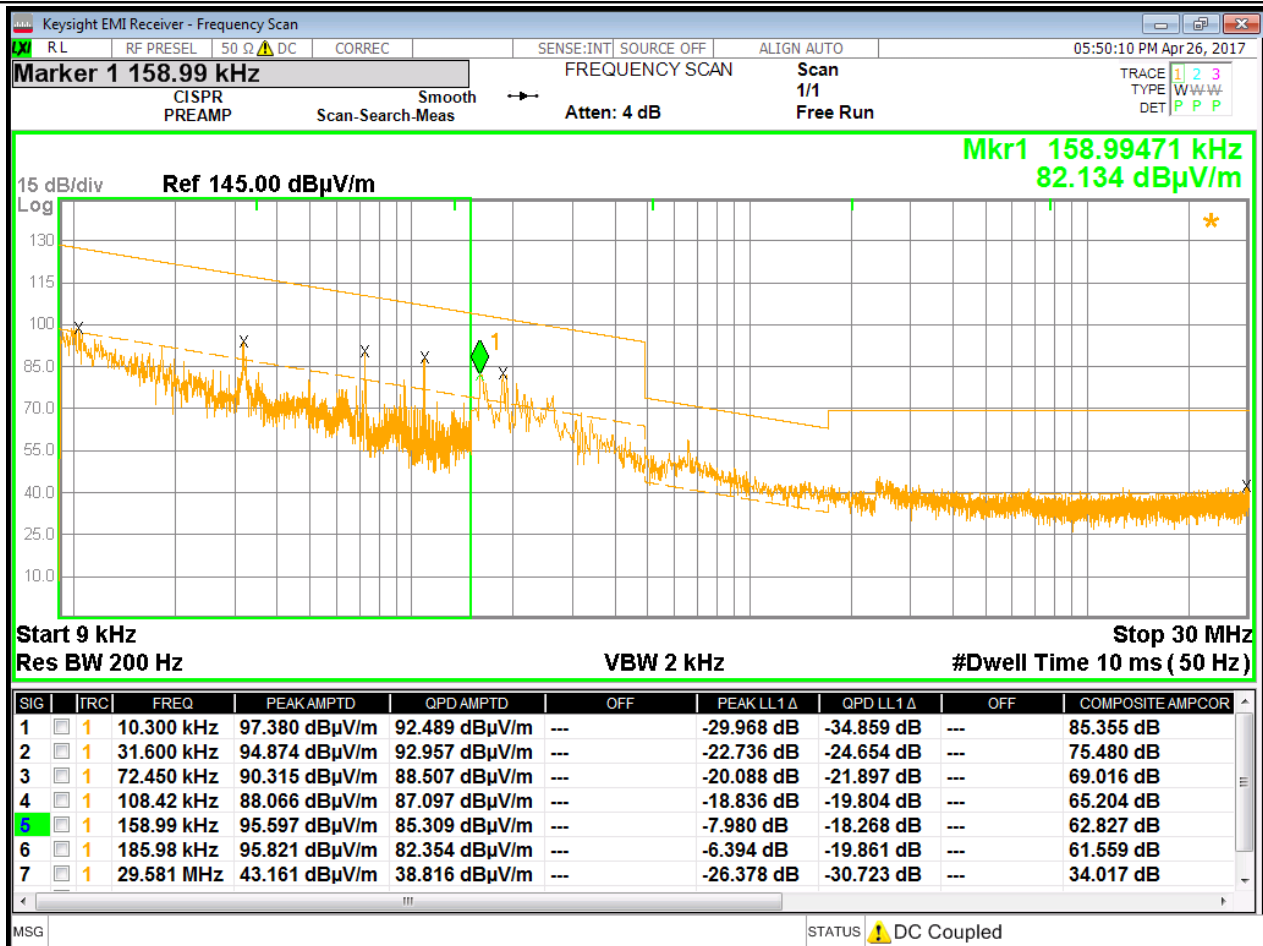


Fig. 4.12

Record of the measurement of radiated emissions (PK)
 Maximum disturbance determined in the frequency range 0.009 – 30 MHz, Pol. Orthogonal.

5. POWER LINES CONDUCTED EMISSIONS

Equipment shall meet the limits below when using a CISPR16 quasi-peak and average detector receivers.

FCC 15.207

FREQUENCY RANGE (MHz)	QUASI-PEAK LIMIT [dB (μV)]	AVERAGE LIMIT [dB (μV)]
0.15 – 0.50	66 – 56 ^(*)	56 – 46 ^(*)
0.50 – 5	56	46
5 – 30	60	50

^(*) Limit decreasing linearly with logarithm of frequency

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
MXE EMI Receiver	Agilent	N9038A	01/2018
Screened Room	GSD	CSC01	01/2018
LISN	GSD	GSDA01	01/2018
LISN	COMTEST	---	01/2018

Test procedure: CE22R01

The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a spectrum analyzer by a transient limiter. The conducted emissions from 150 kHz to 30 MHz were monitored and compared to the specification limits

Test method

Test method was in accordance with the reference standard.

EUT modes of operations were tested in order to achieve the maximum level of emission.

Results

Equipment complied with the test specification limits.

Graphics in following figures show some registrations of the frequency spectrum of the conducted emissions.

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Job Number FCC-17337
 Test Name Powerline Conducted Emissions
 FCC 15.207
 EUT Name R1170IU

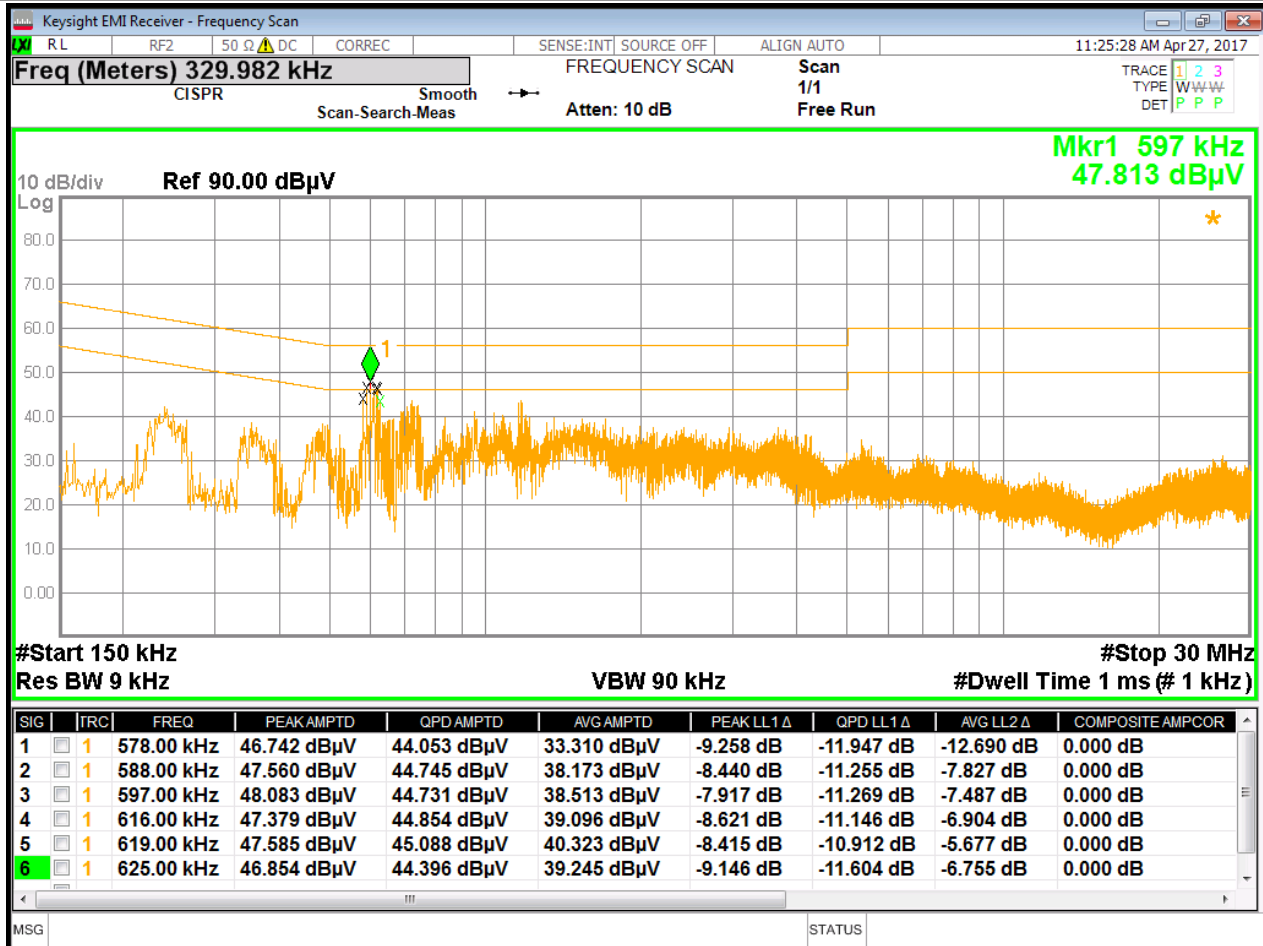


Fig. 5.1 – standby
 B Band (0.15 – 30 MHz): line 1

Job Number FCC-17337
 Test Name Powerline Conducted Emissions
 FCC 15.207
 EUT Name R1170IU

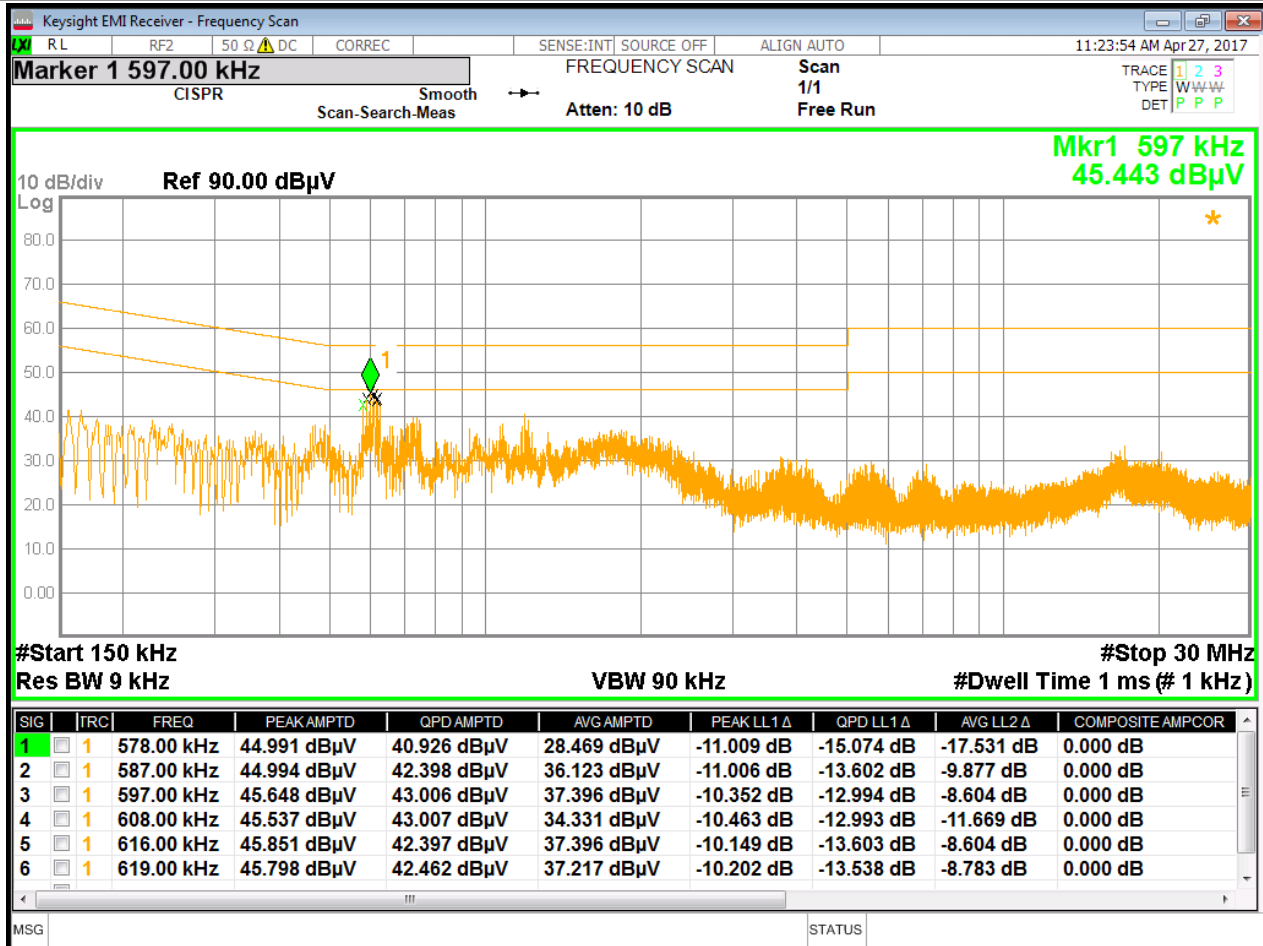


Fig. 5.2 – standby
 B Band (0.15 – 30 MHz): line 2

Job Number FCC-17337
 Test Name Powerline Conducted Emissions
 FCC 15.207
 EUT Name R1170IU

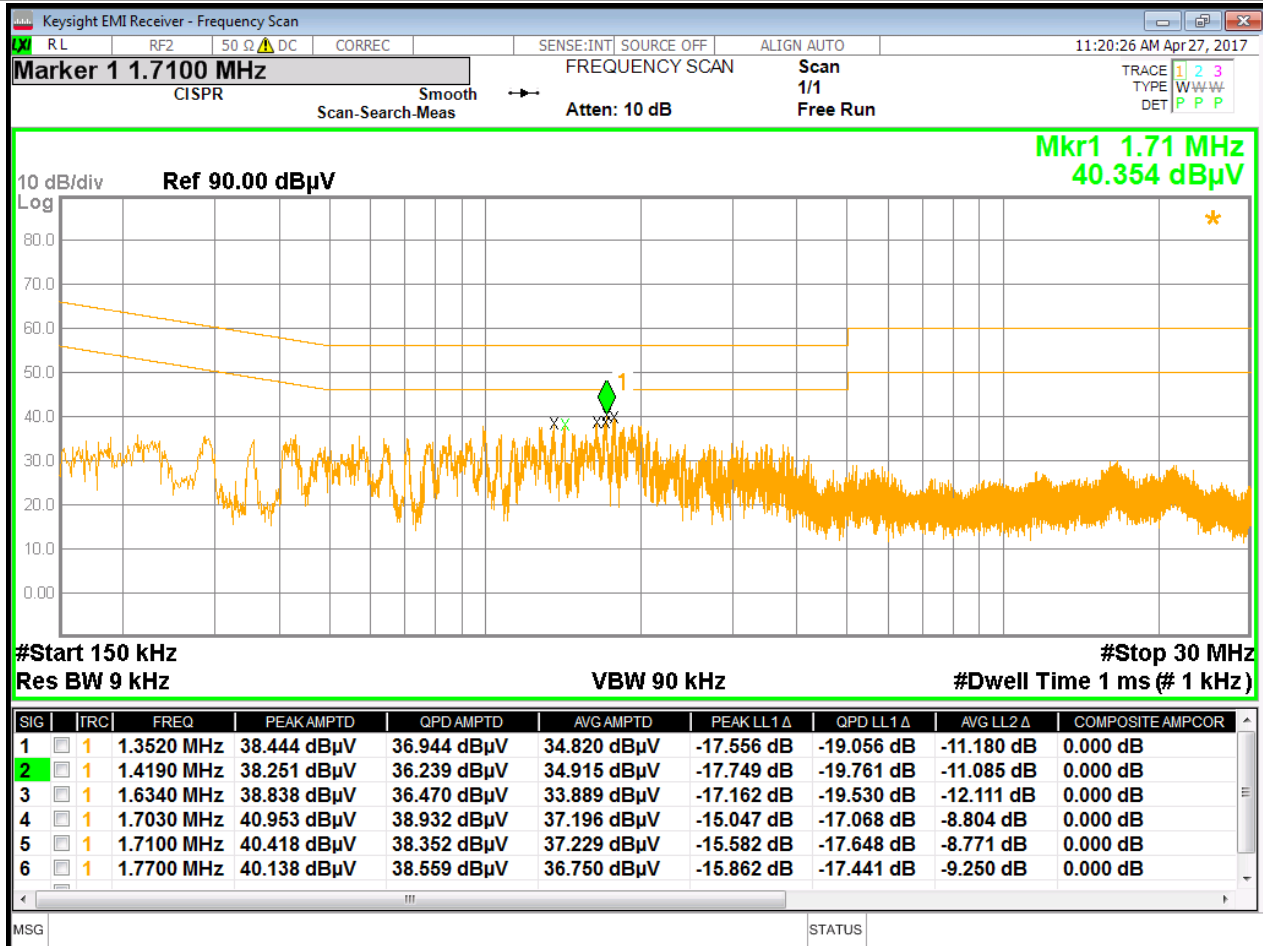


Fig. 5.3

B Band (0.15 – 30 MHz): line 1

Job Number FCC-17337
 Test Name Powerline Conducted Emissions
 FCC 15.207
 EUT Name R1170IU

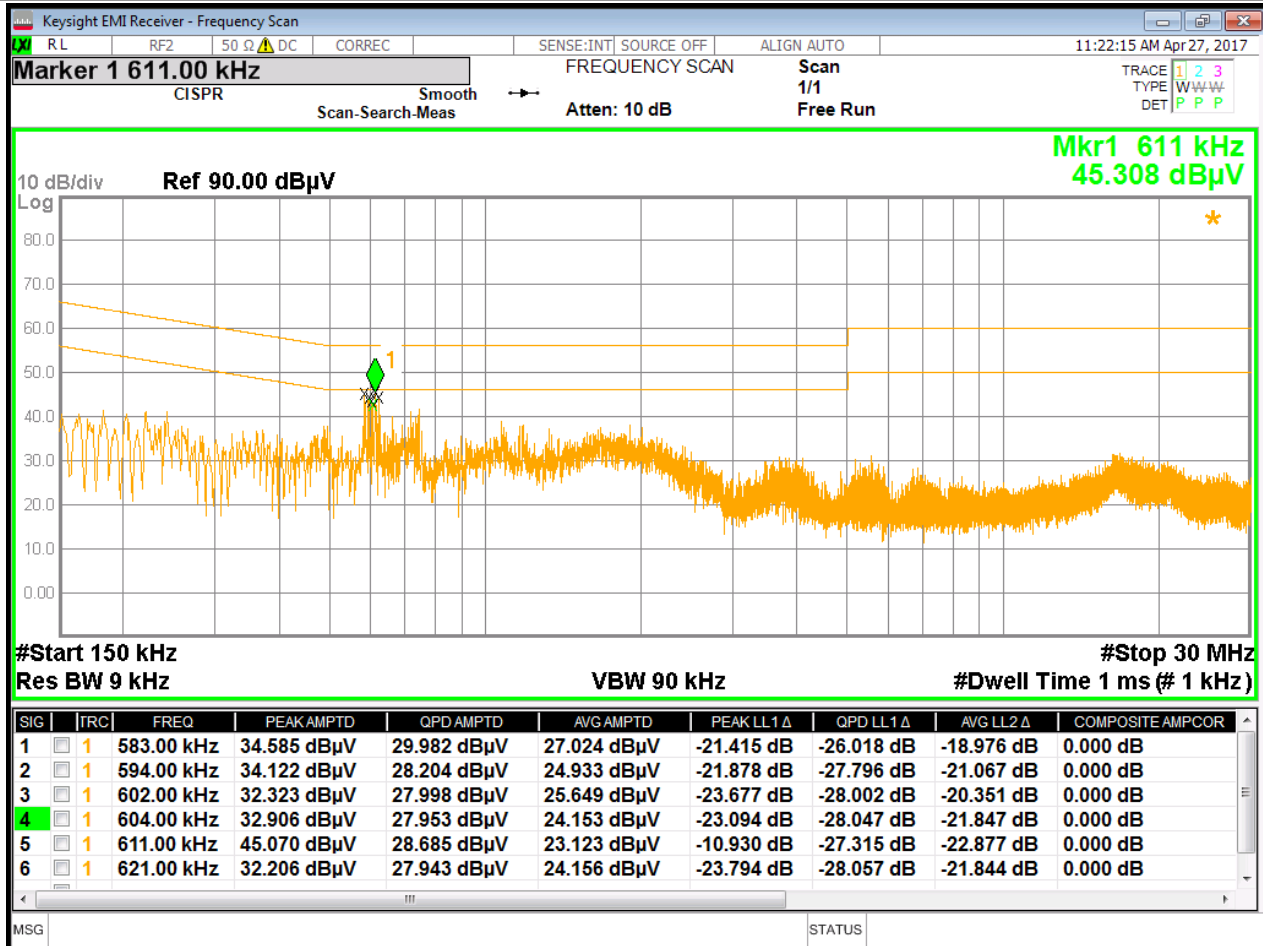


Fig. 5.4

B Band (0.15 – 30 MHz): line 2

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6. OPERATION WITHIN THE BAND 902 - 928 MHz

6.1. NUMBER OF HOPPING FREQUENCIES

The frequency hopping systems operating in the 902-928 MHz band.

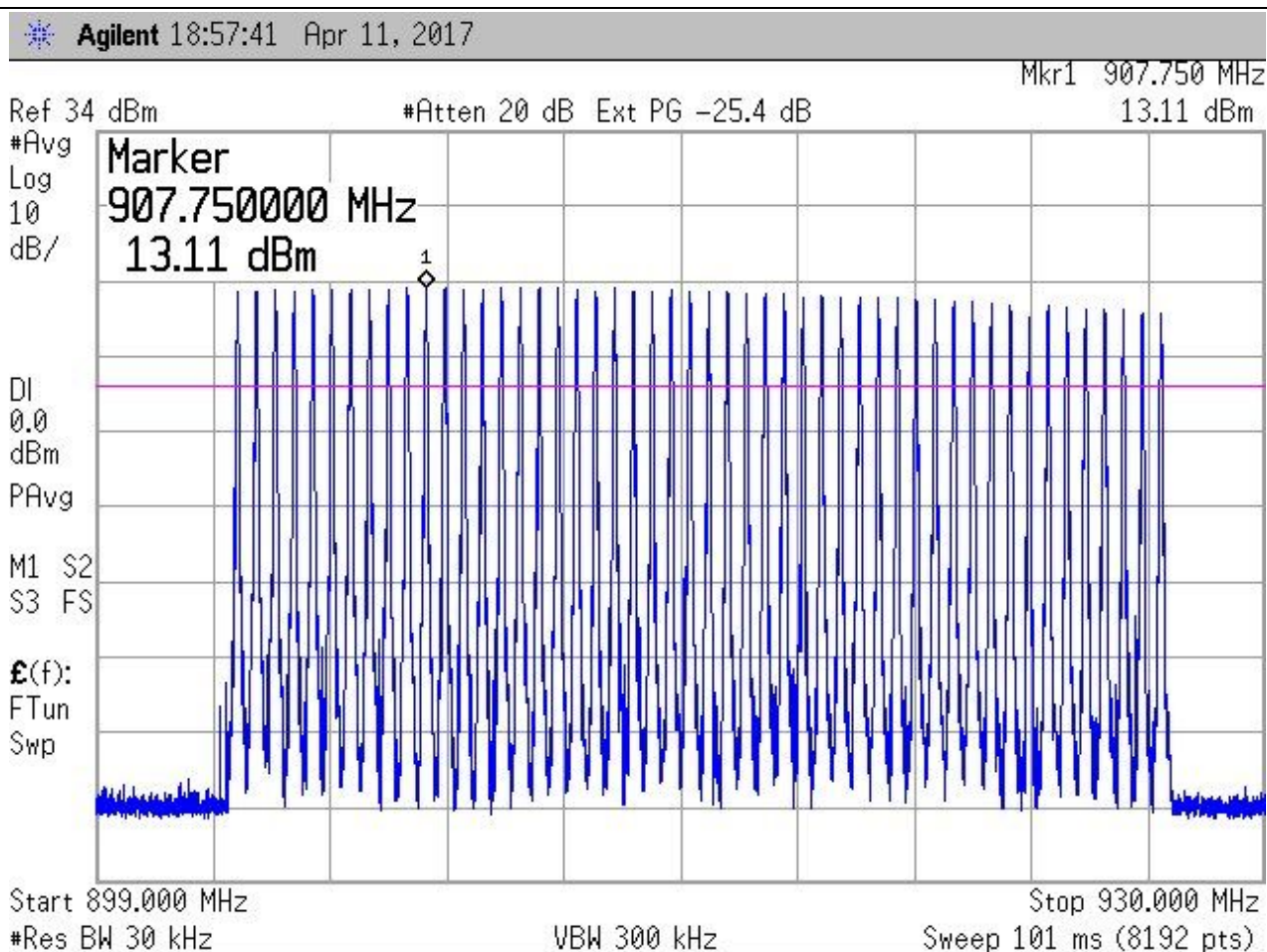


Fig. 6.1

The number of hopping frequencies is 50.

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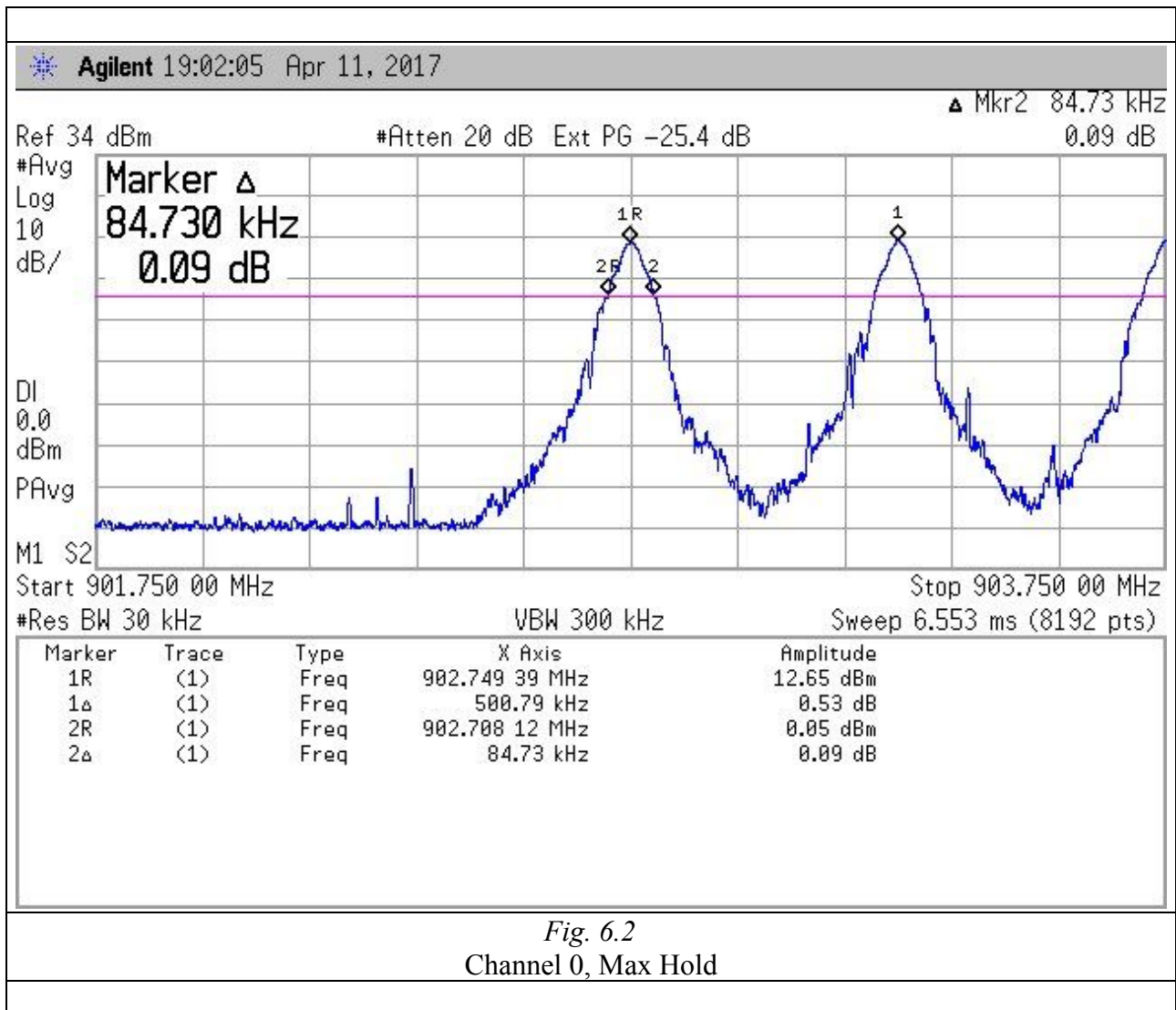
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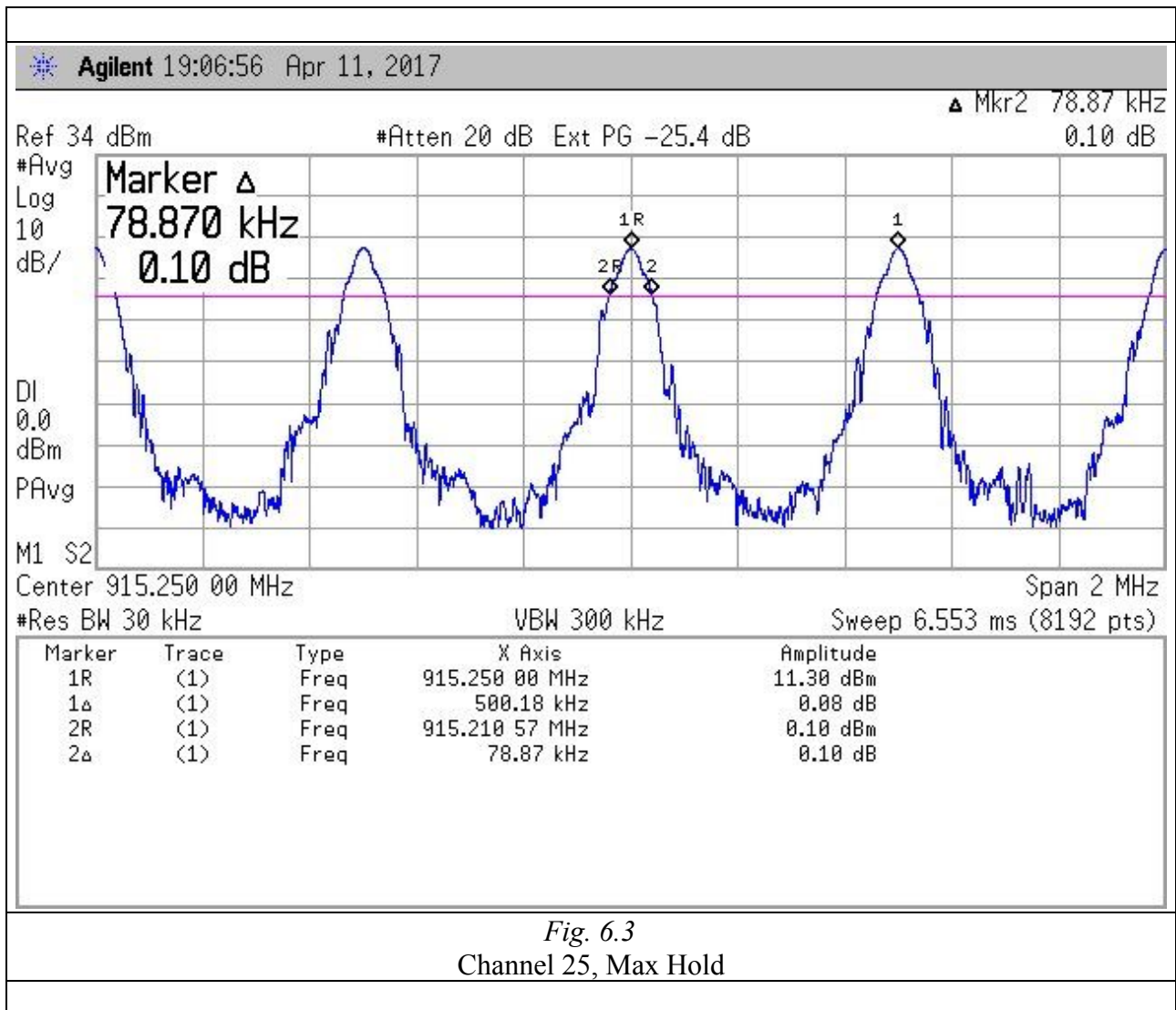
6.2. CARRIER FREQUENCY SEPARATION

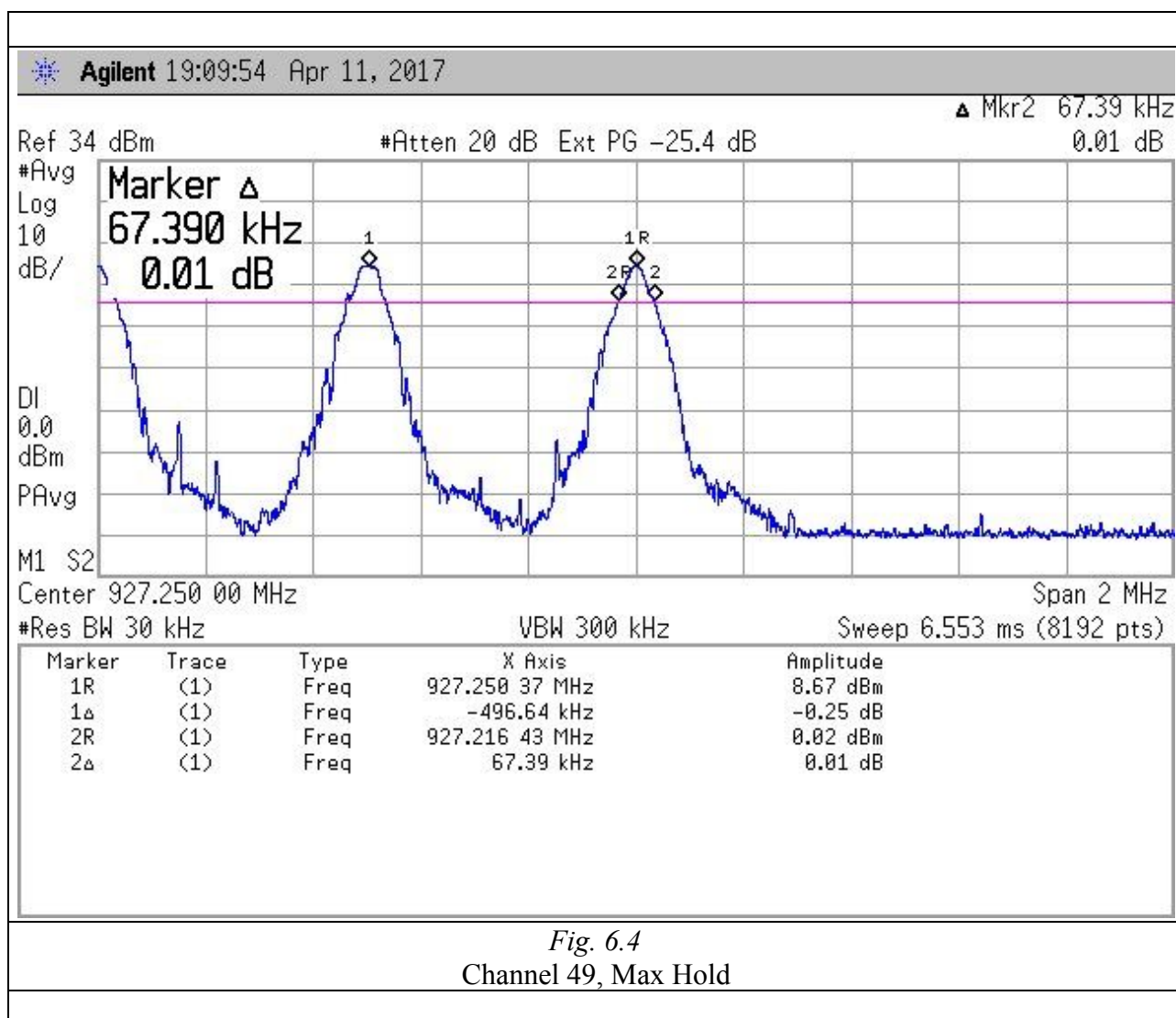
The frequency hopping systems operating in the 902-928 MHz band.

The measured values are:

	Channel	Carrier Separation (kHz)	
	0	500.79	
	25	500.18	
	49	496.64	





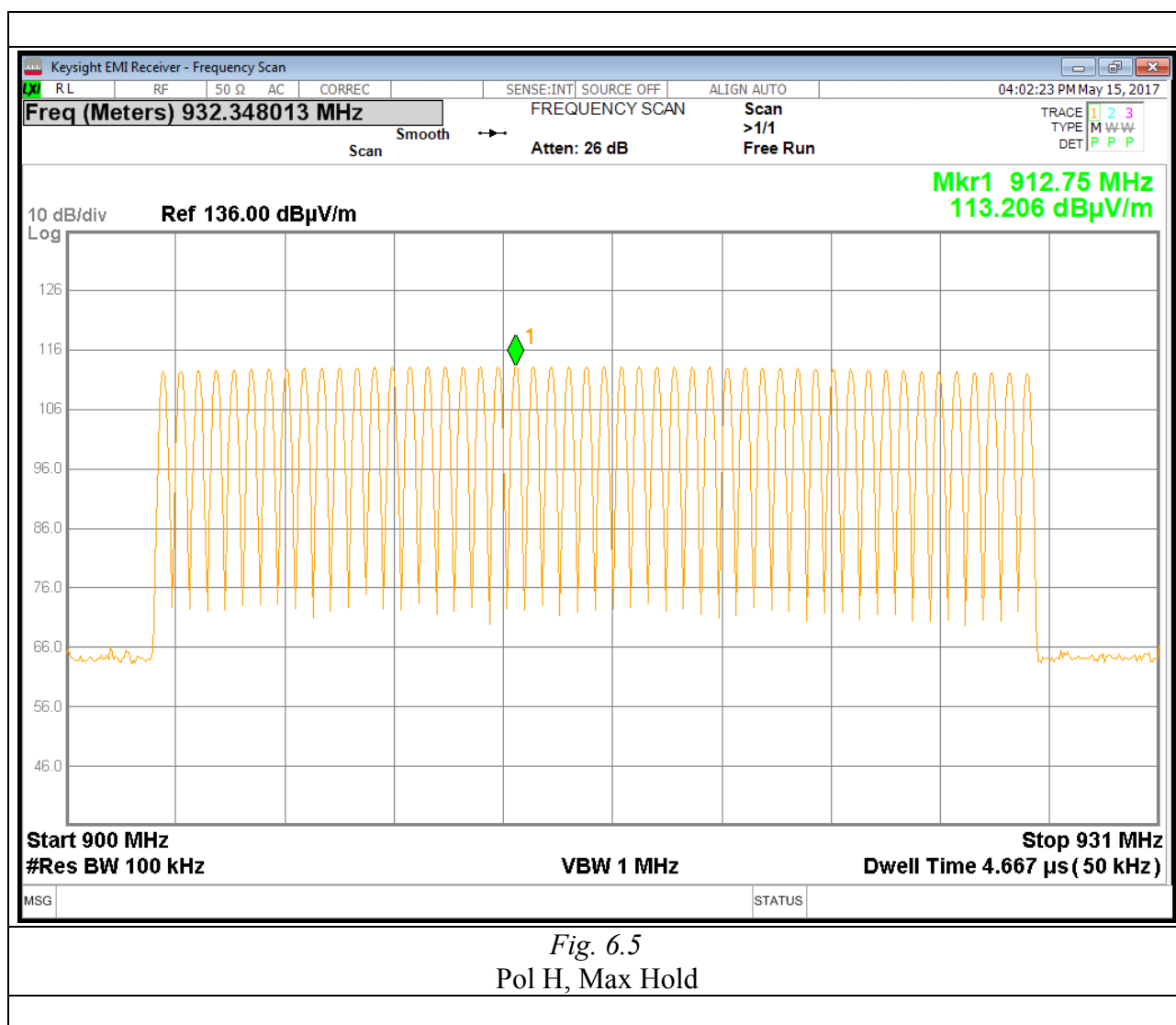


6.3. PEAK OUTPUT POWER (RADIATED)			
Equipment shall meet the limits below.			
FREQUENCY RANGE (MHz)		RF POWER OUTPUT LIMIT (dBm)	
902 - 928		36.0	
The measured values are:			
	Channel	Output Power	
		(dBμV/m)	(dBm erp)
	0	111.36	16.1
	25	113.15	17.9
	49	112.07	16.8
The power was calculated according to the formula:			
$P_{erp} = \frac{(E \cdot d)^2}{30}$			
which comes from the document “DA 00-705 (30 March 2010) – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems”			

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6.4. SPURIOUS EMISSIONS

In the following table, are shown the absolute maximum values (measured without making reference to the polarization of acquisition).

Nr Harmonics	AV Level (dBμV/m)						AV Limits (dBμV/m)	Remark
	Ch 0		Ch 25		Ch 49			
	F (MHz)	(dBμV/m)	F (MHz)	(dBμV/m)	F (MHz)	(dBμV/m)		
2	1805.5	43.58	1830.5	40.35	1854.5	37.87	54.0	
3	2708.25	47.87	2745.75	43.78	2781.75	35.66	54.0	
4	3611	--	3661	--	3709	--	54.0	
5	4513.75	--	4576.25	43.09	1636.25	--	54.0	
6	5416.55	48.91	5491.5	47.38	5563.5	39.69	54.0	
7	--	--	--	--	--	--	54.0	
8		--		--		--	54.0	
9		--		--		--	54.0	
10		--		--		--	54.0	

Note: Levels below 20 dB of limits are indicated with (--).

Nr Harmonics	Peak Level (dBμV/m)						Peak Limits (dBμV/m)	Remark
	Ch 0		Ch 25		Ch 49			
	F (MHz)	(dBμV/m)	F (MHz)	(dBμV/m)	F (MHz)	(dBμV/m)		
2	1805.5	47.91	1830.5	45.69	1854.5	43.32	74.0	
3	2708.25	51.65	2745.75	48.95	2781.75	45.28	74.0	
4	3611	--	3661	--	3709	--	74.0	
5	4513.75	--	4576.25	49.65	1636.25	--	74.0	
6	5416.55		5491.5	53.09	5563.5	49.59	74.0	
7		--		--		--	74.0	
8		--		--		--	74.0	
9		--		--		--	74.0	
10		--		--		--	74.0	

Note: Levels below 20 dB of limits are indicated with (--).

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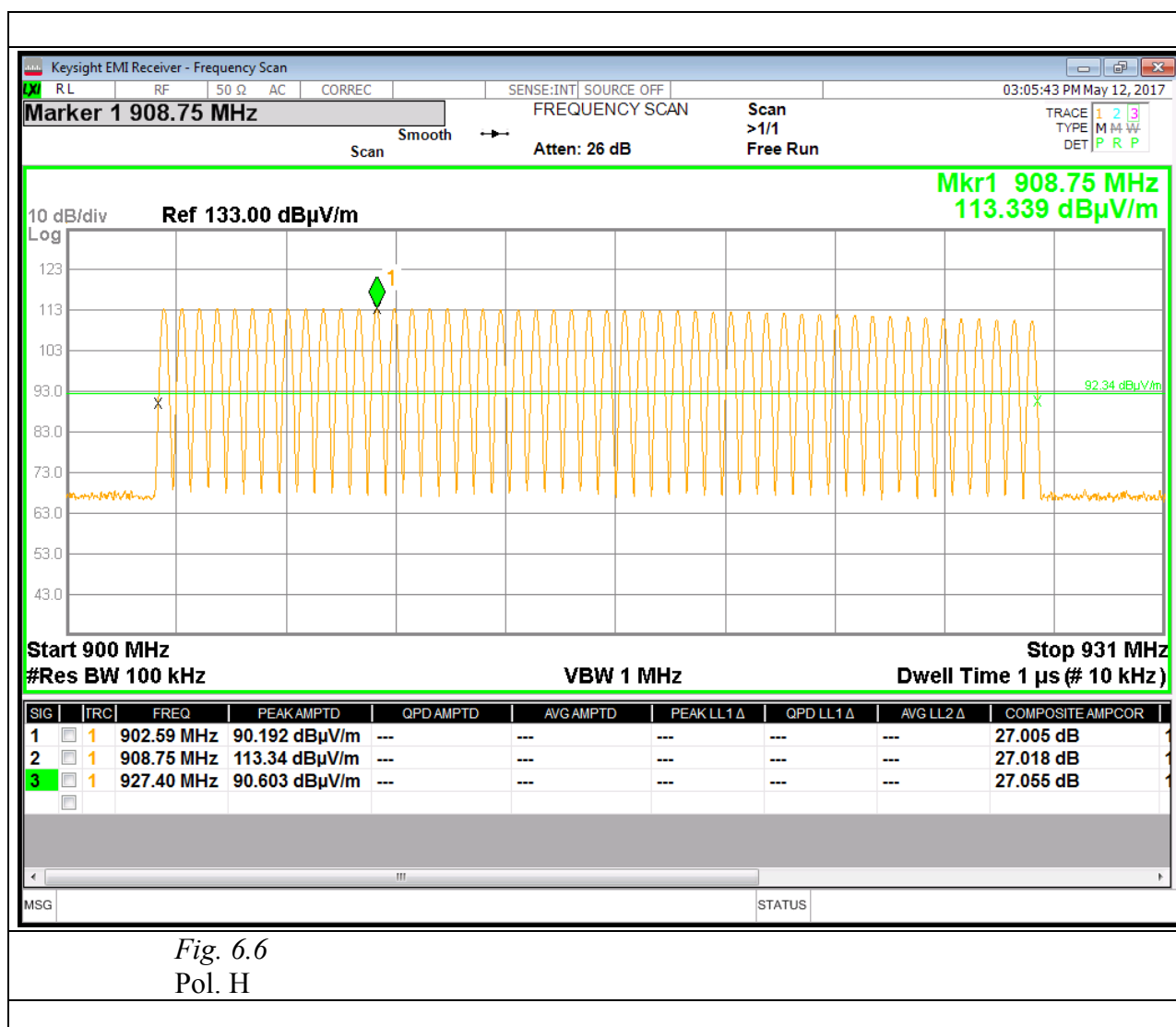
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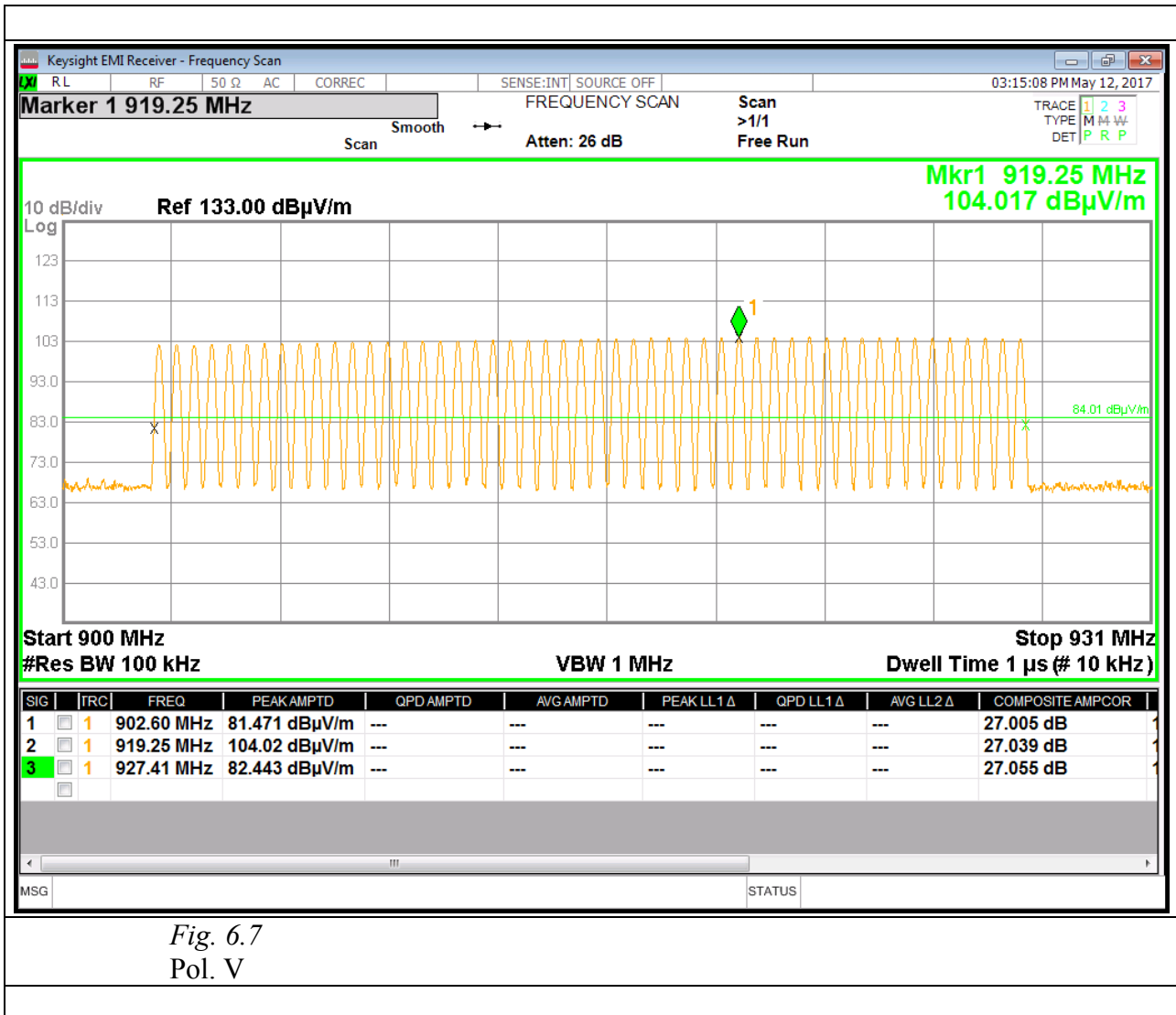
6.5.	BAND EDGE
Emissions must be within the band 902-928 MHz.	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below 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, provided the transmitter demonstrates compliance with the peak conducted power limits.	

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<u>Test Equipment</u>			
EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
MXE EMI Receiver	Agilent	N9038A	01/2018
Anechoic Chamber	Comtest	CSA01	01/2018
Bilog Antenna	Schaffner	CBL6112B	01/2018
Horn Antenna	EMCO	3115	01/2018
Controller	Deisel	HD100	01/2018
Turn Table	Deisel	MA240	01/2018
Attenuator	Narda	768-10	01/2018
<u>Test procedure: CE22R01</u>			

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7. BANDWIDTH AND AVERAGE TIME OF OCCUPANCY

Equipment shall meet the limits below.

Systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Bandwidth

Channel	Frequency [MHz]	Bandwidth [kHz]
0	902.74975	55.6
25	915.24950	58.4
49	927.25000	62.7

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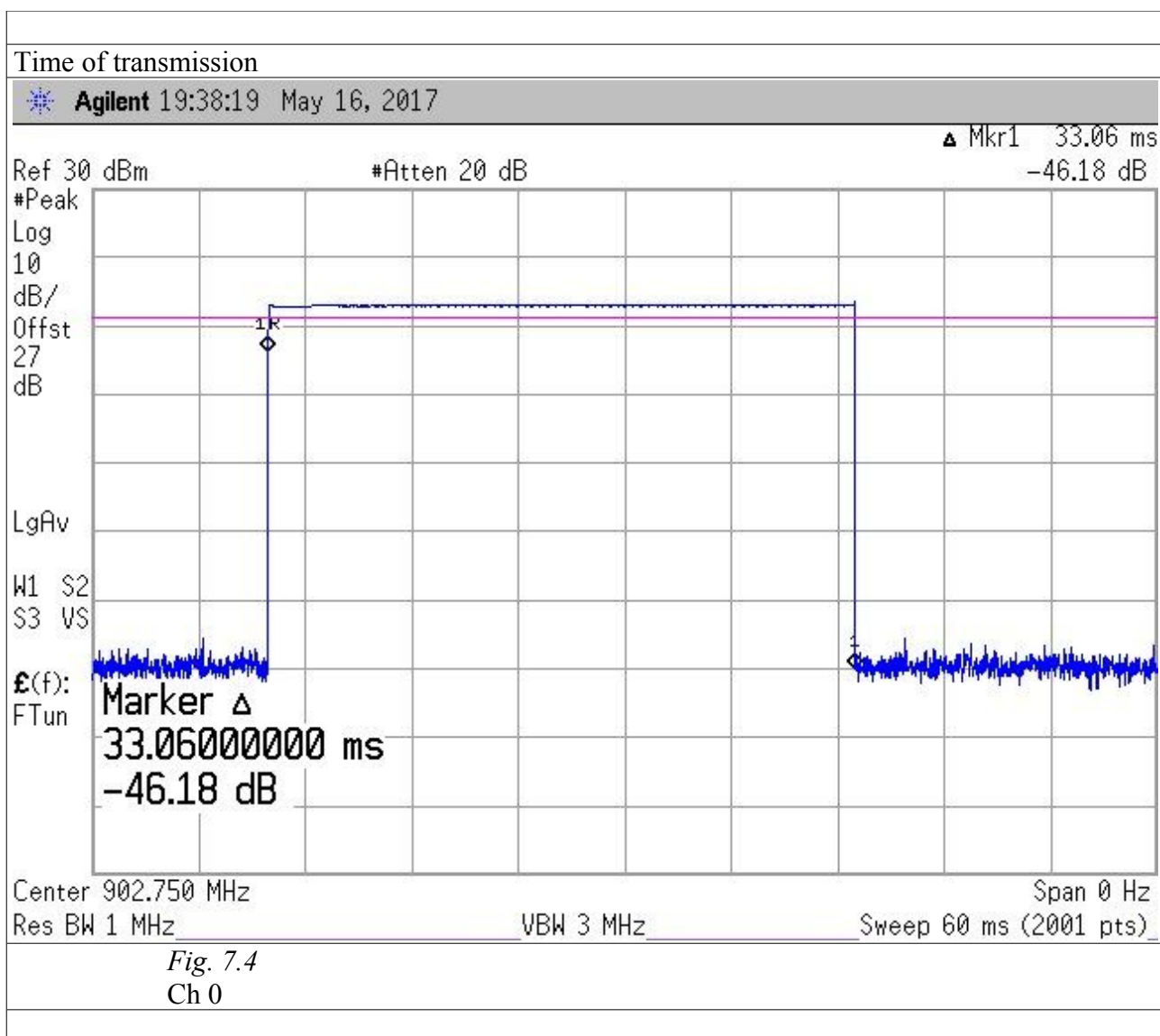
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<i>Average Time of Occupancy:</i>			
Channel	Dwell Time (ms)	Nr. of Transmission for channel [average]	Time of Occupancy (ms) [average]
0	33.06	4 [4.26]	132.2 [141.0]
25	33.99	4 [4.27]	136.0 [145.2]
49	33.06	4 [4.27]	132.2 [141.3]

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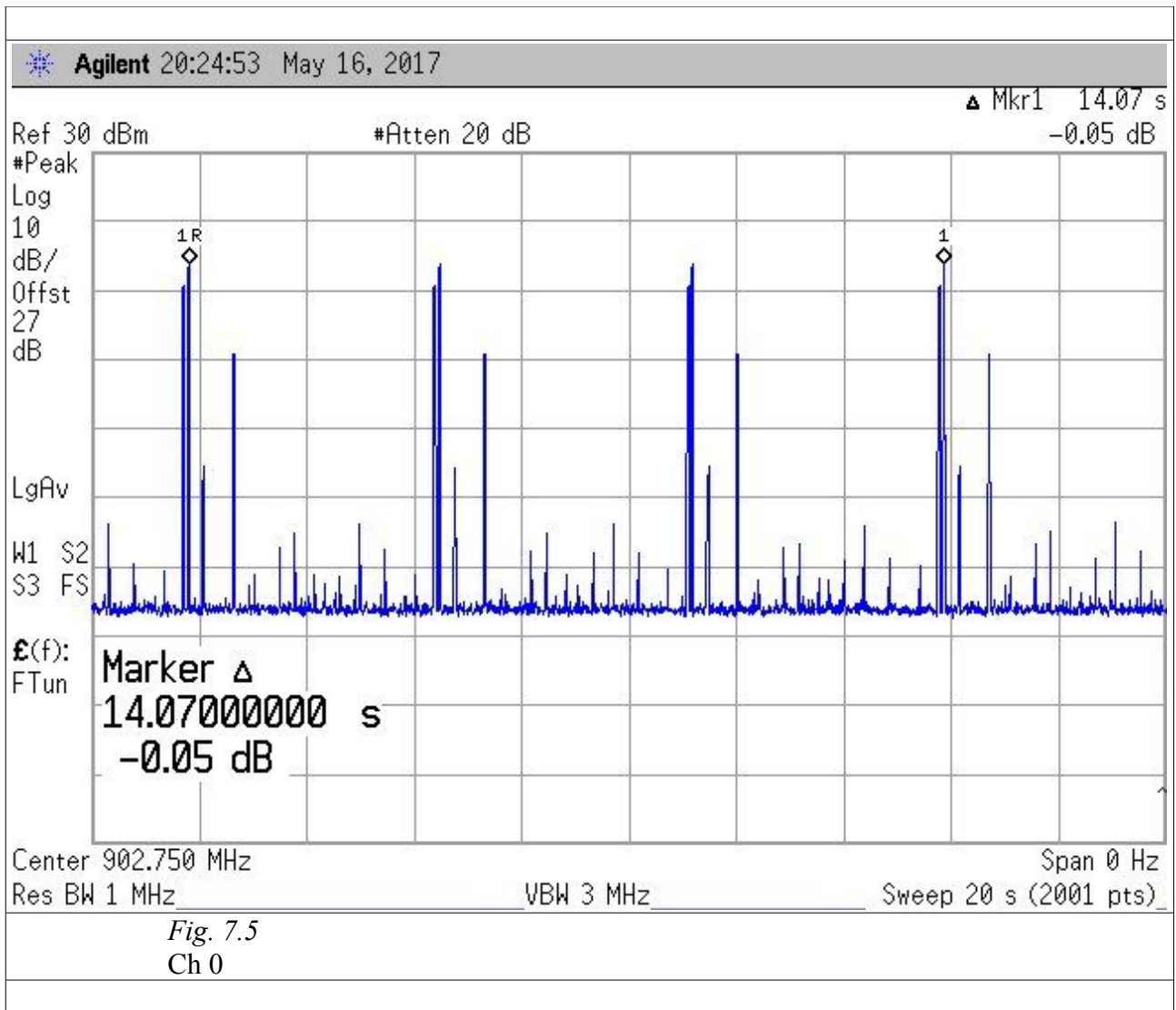
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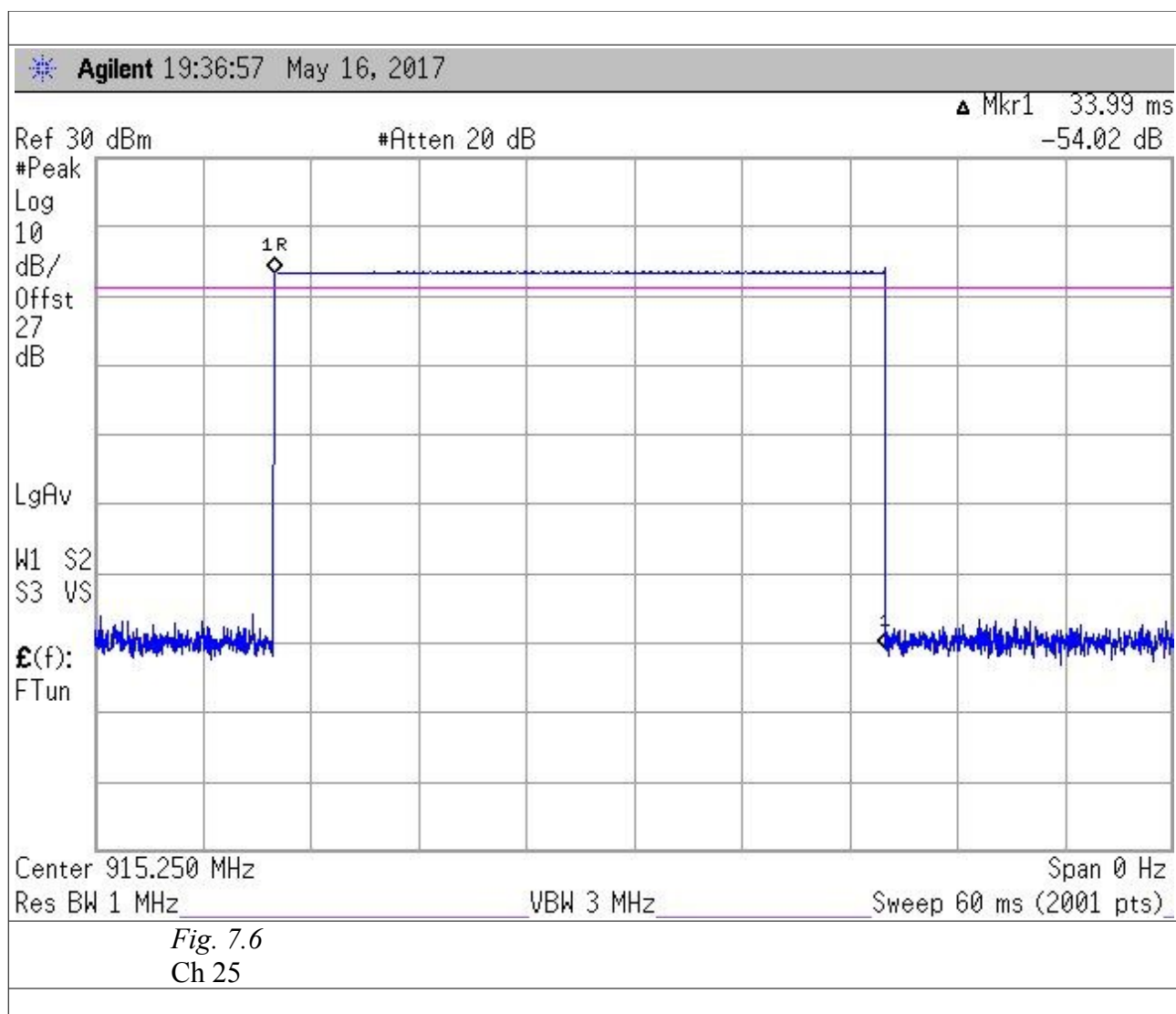


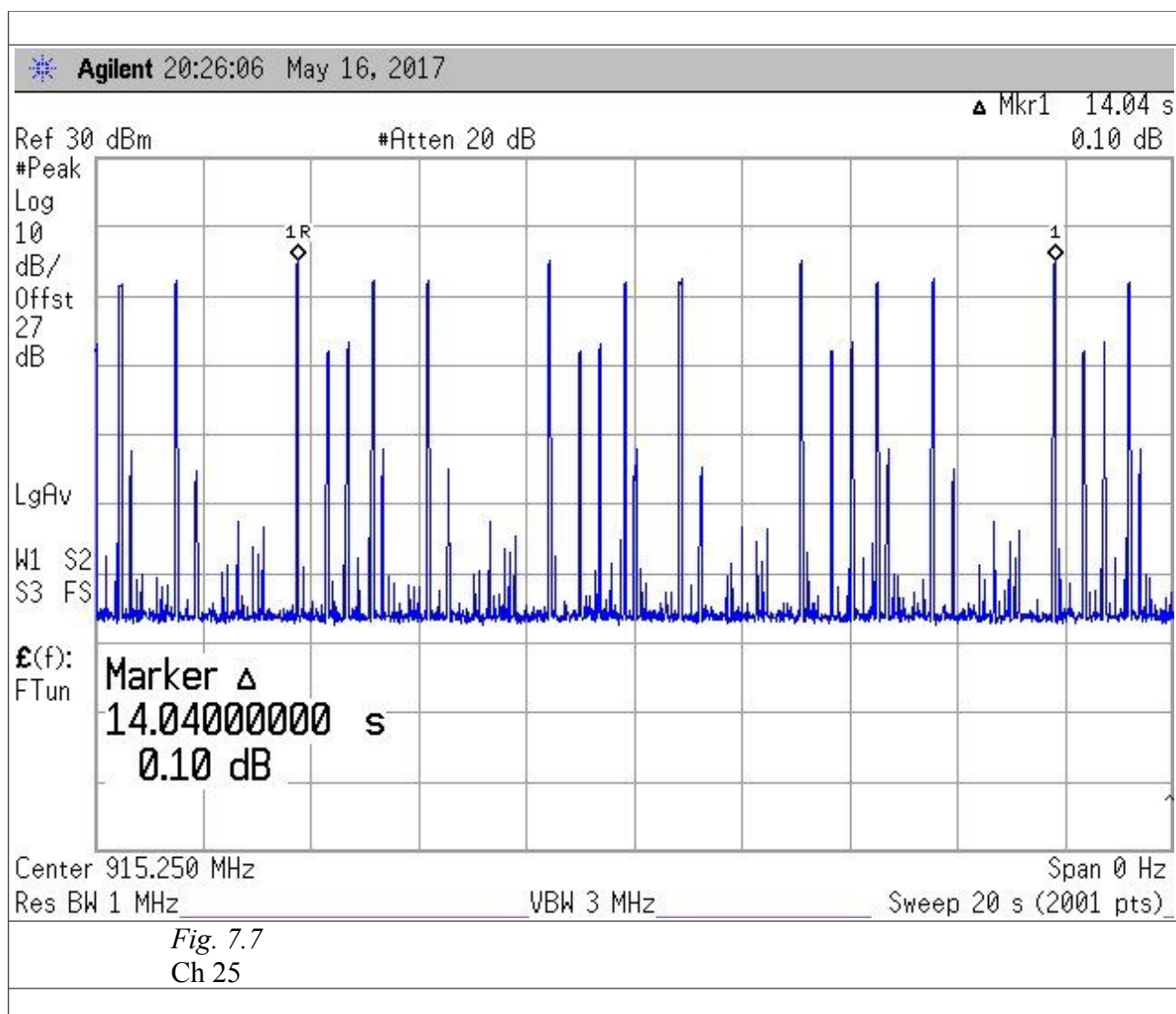
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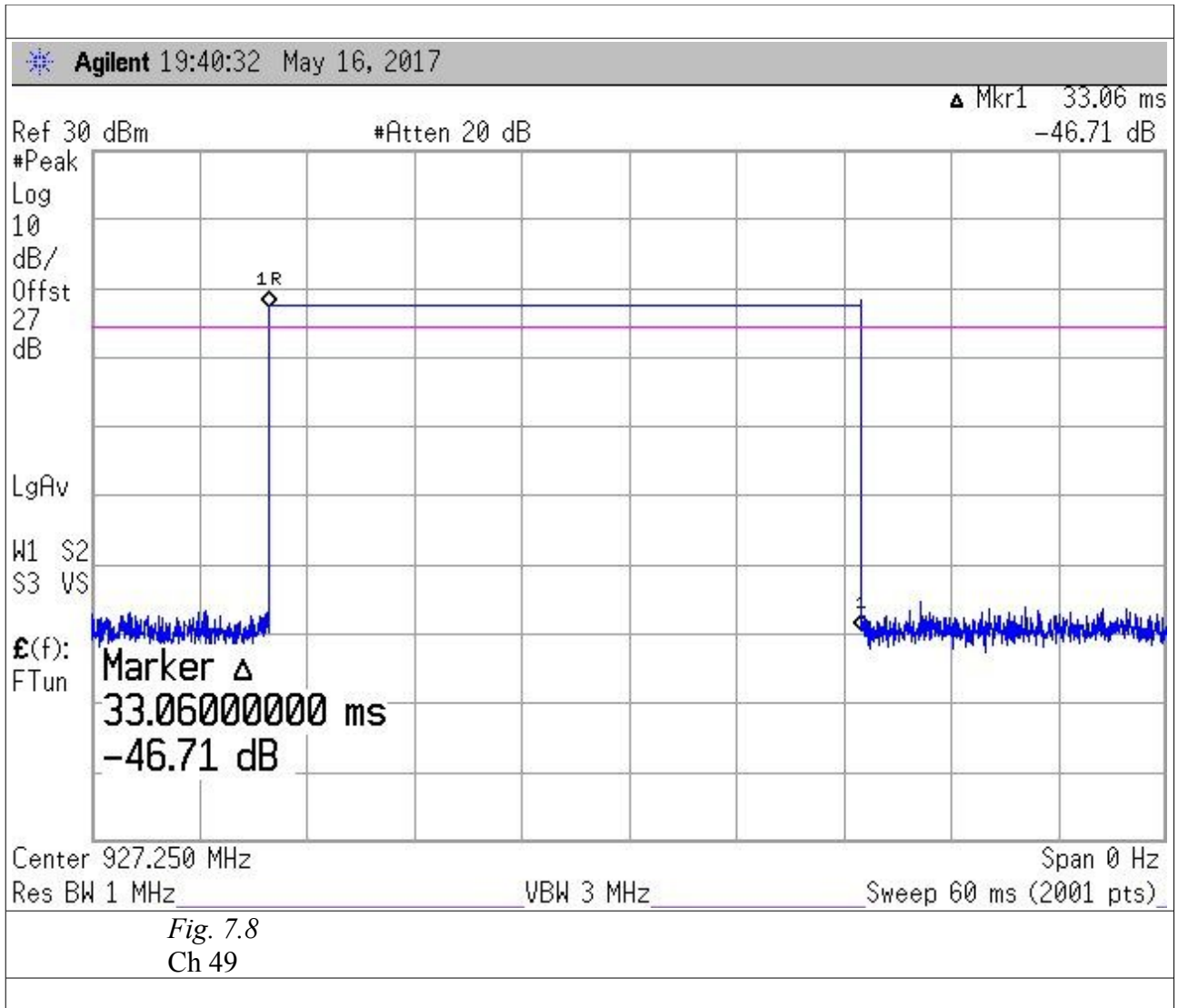
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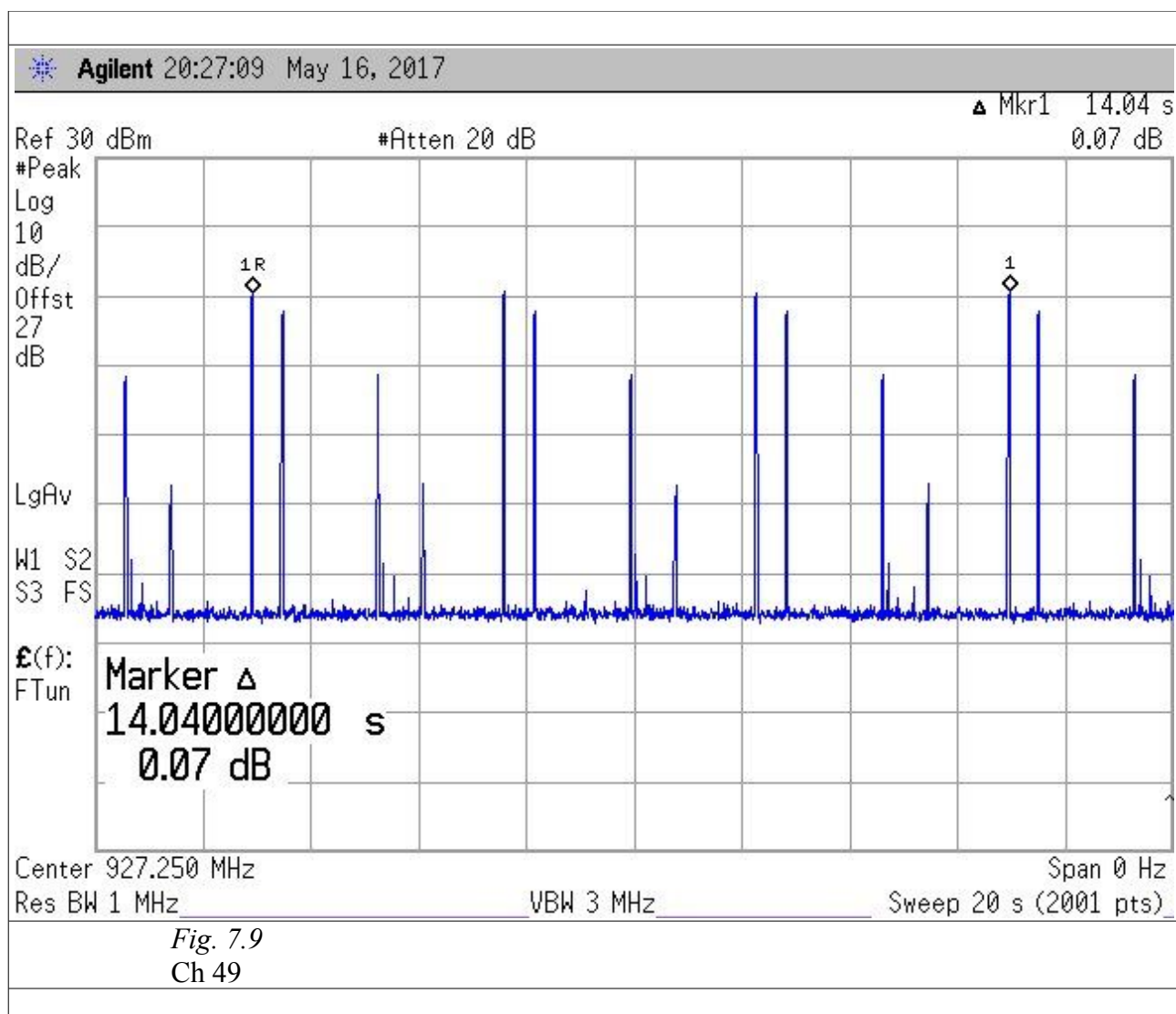
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<u>Test Equipment</u>			
EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
PSA Spectrum Analyzer	Agilent	E4440	01/2018
RF Preselector	Agilent	N9039A	01/2018
Anechoic Chamber	Comtest	CSA01	01/2018
Bilog Antenna	Schaffner	CBL6112B	01/2018
Horn Antenna	EMCO	3115	01/2018
Controller	Deisel	HD100	01/2018
Turn Table	Deisel	MA240	01/2018
<u>Test procedure: RE22R01</u>			

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8. PHOTO



Fig. 8.1

Conducted Emissions Test Set-up



Fig. 8.2

Radiated Emissions Test Set-up



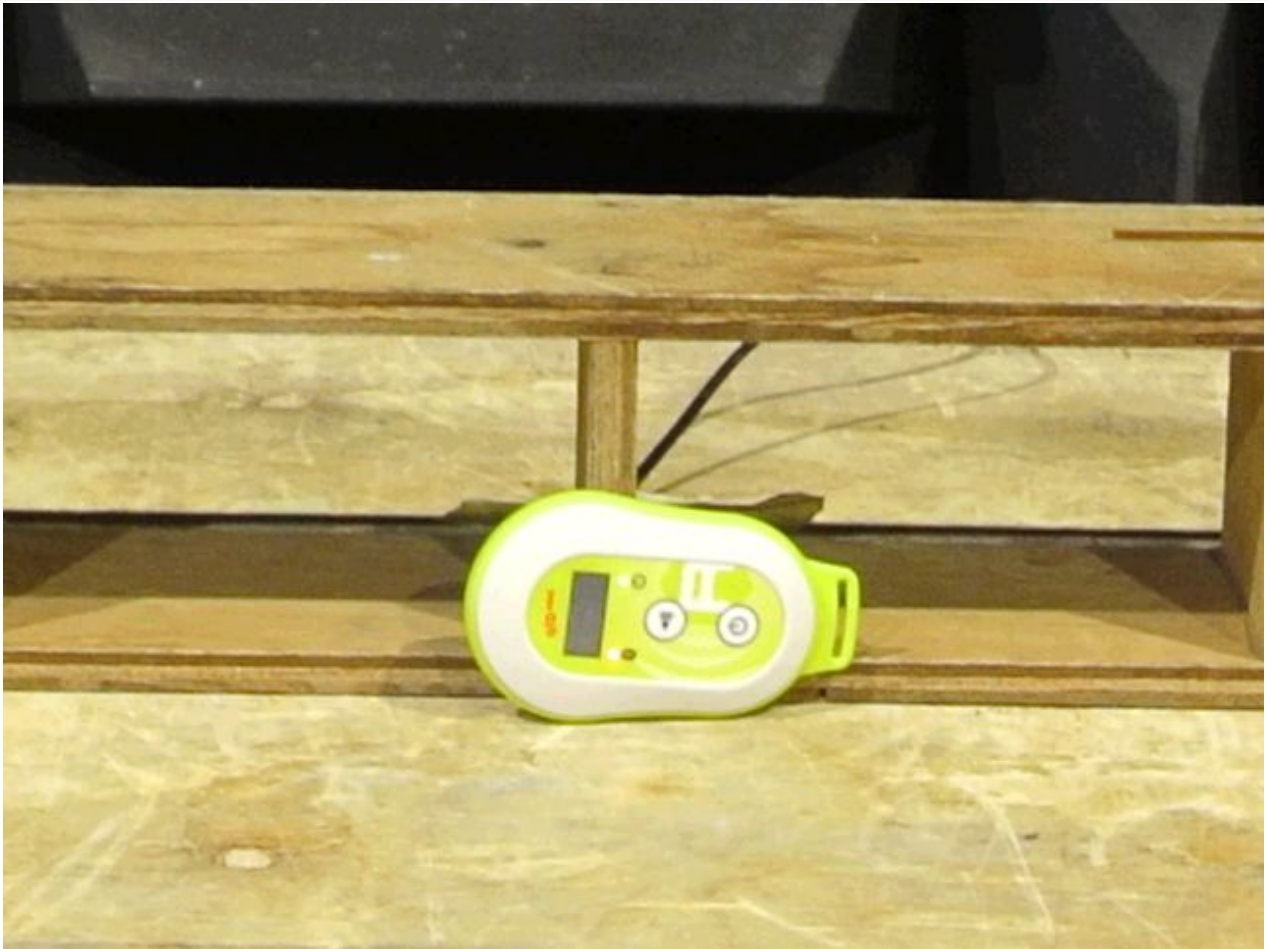
Fig. 8.3

Radiated Emissions Test Set-up



Fig. 8.4

Radiated Emissions Test Set-up



*Fig. 8.5 - Particular
Radiated Emissions Test Set-up*