

# Test Report

<b>Product</b>	Hearing protection with two-way radio headset
<b>Name and address of the applicant</b>	3M Svenska AB Malmstengatan 19 SE-33102 Värnamo, Sweden
<b>Name and address of the manufacturer</b>	3M Svenska AB Malmstengatan 19 SE-33102 Värnamo, Sweden
<b>Model</b>	ComTac VI
<b>Rating</b>	Primary internal batteries, 3V DC (2 x 1.5V AAA/LR03 batteries)
<b>Trademark</b>	3M™ PELTOR™ ComTac™ VI
<b>Serial number</b>	/
<b>Additional information</b>	Radio headset, 915.500MHz
<b>Tested according to</b>	<b>FCC Part 15.249</b> Low Power Transmitter. 902 – 928MHz <b>Industry Canada RSS-210, Issue 9</b> Licence-Exempt Radio Apparatus, Category I Equipment
<b>Order number</b>	350132
<b>Tested in period</b>	2018-10-30 – 2018-12-07
<b>Issue date</b>	2019-03-28
<b>Name and address of the testing laboratory</b>	<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;">   Instituttveien 6 Kjeller, Norway </div> <div style="text-align: center;"> CAB number:  FCC: NO0001  ISED: NO0470 </div> <div style="text-align: center;">    </div> </div> <p style="text-align: center; color: red; font-size: small;">An accredited technical test executed under the Norwegian accreditation scheme</p>
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%; text-align: center;">   Prepared by [G.Suhanthakumar] </div> <div style="width: 45%; text-align: center;">   Approved by [Frode Sveinsen] </div> </div>	
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## 1 INFORMATION

### 1.1 Test Item

Name	3M Peltor
FCC ID	Y9ZMT20H682
Industry Canada ID	4406A- MT20H682
Model/version	ComTac VI
Serial number	/
Hardware identity and/or version	K401AVB
Software identity and/or version	1.0.6
Frequency Range	915.5MHz
Tunable Bands	None
Number of Channels	1
Operating Modes	Transceiver
Type of Modulation	4GFSK
User Frequency Adjustment	None
Rated Output Power	0.2 mW
Type of Power Supply	Primary internal batteries, 2 x 1.5V AAA/LR03 batteries
Antenna Connector	None, PCB antenna
Antenna Diversity Supported	No
Desktop Charger	No

#### Description of Test Item

Hearing protector with ISM full duplex radio link and MI receiver. This test report covers only 915.5MHz communication.

#### Theory of Operation

The EUT is a headset/handsfree which ISM full duplex radio, Magnetic induction (MI) receiver and a cable to be connected to other devices. It provides a function to listen to surrounding sound and is not only a closed audio headset. The headset is a hearing protection with level-dependent function for ambient listening.

## 1.2 Normal test condition

Temperature: 20 - 24 °C  
Relative humidity: 20 - 50 %  
Normal test voltage: 3.0 V DC

The values are the limit registered during the test period.

## 1.3 Test Engineer(s)

G. Suhanthakumar

## 1.4 Description of modification for Modification Filing

Not applicable.

## 1.5 Family List Rational

Not Applicable.

## 1.6 Antenna Requirement

Is the antenna detachable?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

## 1.7 Worst-Case Configuration and Mode

Radiated Emissions was performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

## 1.8 Comments

All measurements were done with the EUT powered by a fully charged battery.

All ports were populated during spurious emission measurements, i.e. with host device.

## 2 TEST REPORT SUMMARY

### 2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, clause 15.249 and ISED Canada RSS-210 Issue 9.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were made in a semi-anechoic chamber at measuring distances of 1m, 3m and 10m.

A description of the test facility is on file with the FCC and Industry Canada.

☒ New Submission

☐ Class II Permissive Change

**DXT** Equipment Code

☒ Production Unit

☐ Pre-production Unit

☐ Family Listing



#### **THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.**

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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## 2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 9, RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	F.2.2 (RSS-210) 6.11, 8.11 (RSS-Gen)	N/A <sup>1</sup>
Antenna Requirement	15.203	6.7 (RSS-GEN)	Complies <sup>2</sup>
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	N/A <sup>1</sup>
99% Occupied Bandwidth	N/A	6.6 (RSS-GEN)	-
Peak Power Output	15.249(a),(c),(e )	B.10 (RSS-210)	Complies
Band edge emissions	15.249(d)	B.10 (RSS-210)	Complies
Spurious Emissions (Radiated)	15.249(d), 15.209 15.35 (b)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

<sup>1</sup> EUT is battery powered

<sup>2</sup> The EUT has only integrated antenna.

RSS-Gen Issue 5 covers section 6 & 8

RSS-210 issue 9 covers Annex B

## Revision history

Version	Date	Comment	Sign
00	2018-12-07	First edition	gns
01	2019-03-28	Model number corrected	FS

### 3 TEST RESULTS

#### 3.1 99% Occupied Bandwidth

Para. No.: 6.6 RSS-Gen Issue 5

Test Results: -

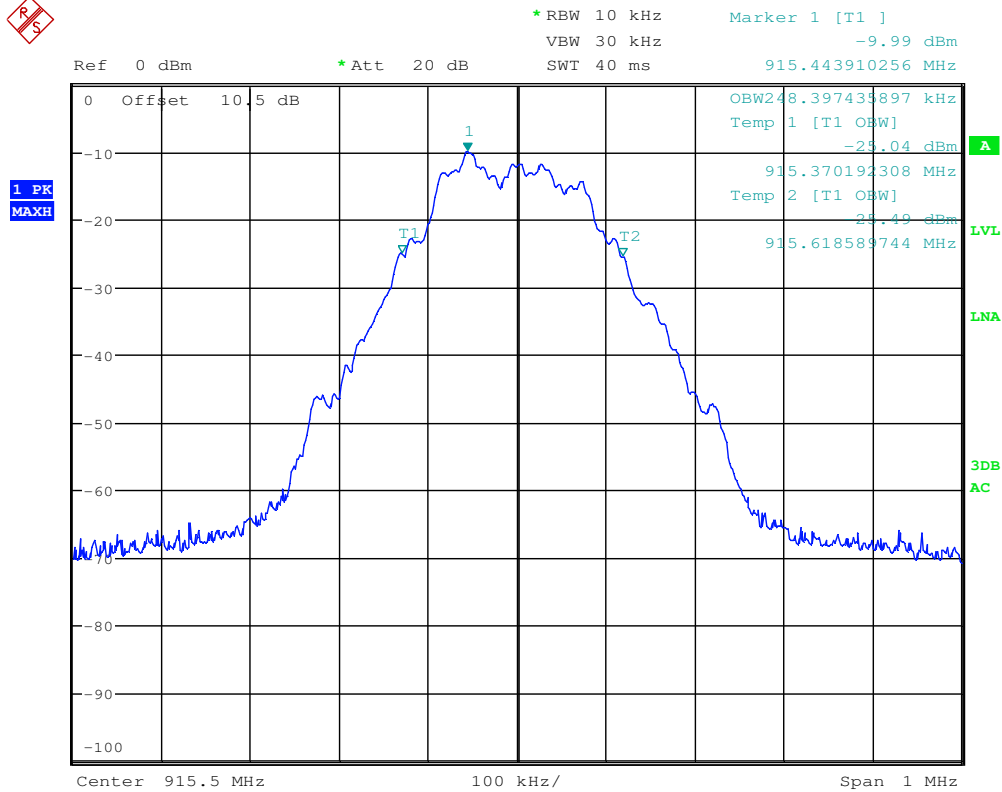
Measurement Data:

Measured 99% Bandwidth (kHz)		
-	915.500 MHz	-
-	248.4	-

See attached plots.

**Requirements:**

No requirement for 99% BW, reported for information only.



Date: 13.NOV.2018 10:03:41

### 99% Bandwidth



## 3.2 Peak Power Output

FCC part 15.249 (a),(c),(e)

**Test Results: Complies**

### Measurement Data:

#### PK detector

	915.5 MHz
Conducted Power (dBm)	-6.96
Conducted Power (mW)	0.20
Field Strength (dBμV/m)	93.69
ERP, Calculated (mW)	0.43
Antenna gain (dBd)	3.3

Measured with 100%.

Antenna gain =  $10 \cdot \log(\text{ERP} / \text{Conducted power})$  dBd

ERP is calculated from measured field strength by the formulas in KDB 412172 D01 Determining ERP and EIRP v01r01.

**See attached plots.**

### Requirements:

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a)

The maximum average output power shall be  $\leq 94$  dBμV/m

and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.



**MARKER 1**

915.4278846 MHz

\* RBW 1 MHz

Marker 1 [T1]

VBW 3 MHz

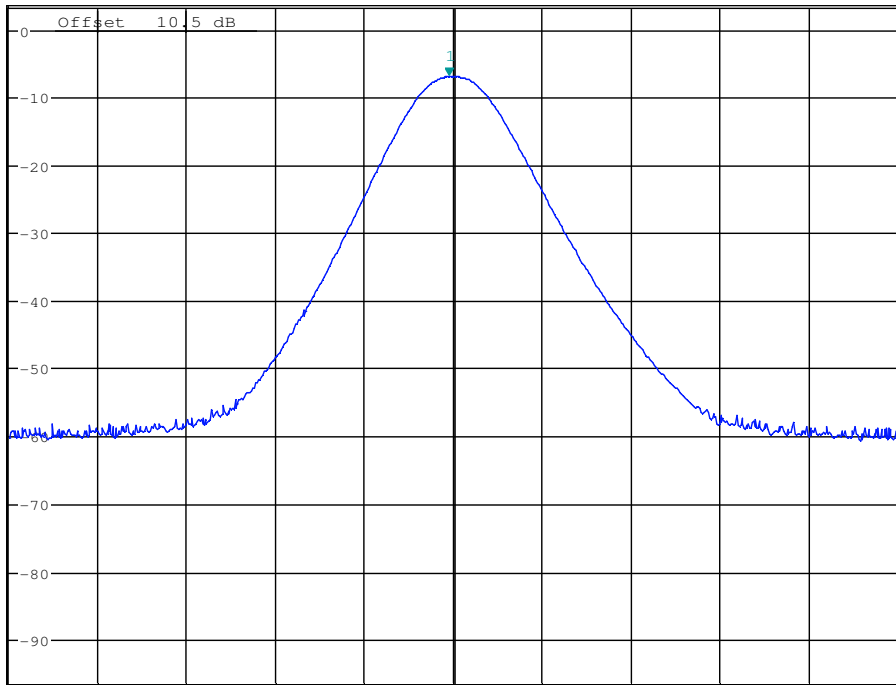
-6.96 dBm

SWT 2.5 ms

915.427884615 MHz

Ref 3.5 dBm \* Att 25 dB

1 PK  
MAXH



Center 915.5 MHz 1.5 MHz/ Span 15 MHz

Date: 13.NOV.2018 09:59:30

Conducted power, 915.5MHz



**MARKER 1**

915.4246795 MHz

\* RBW 1 MHz

Marker 1 [T1]

VBW 3 MHz

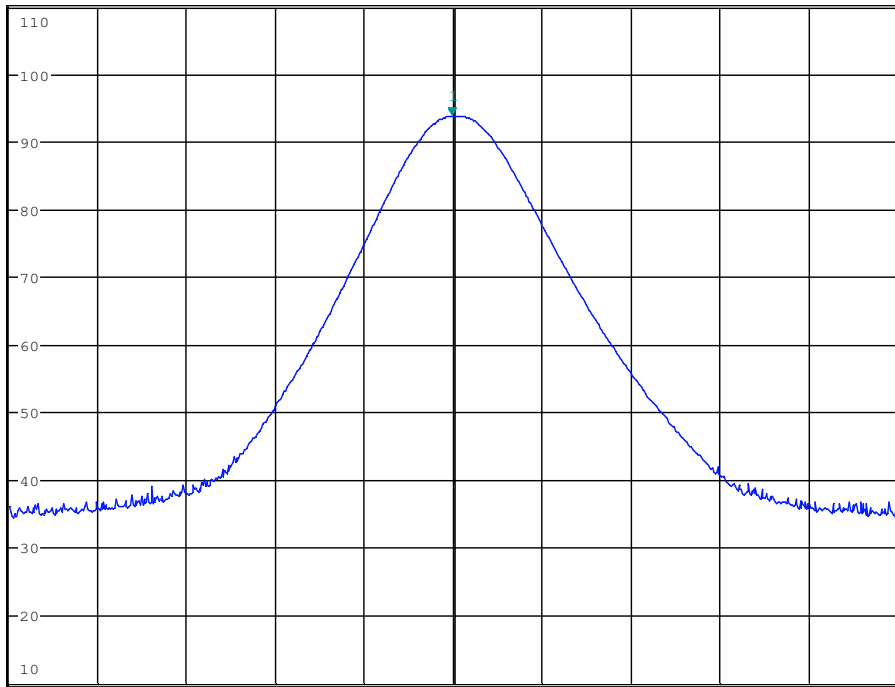
93.69 dBµV/m

SWT 2.5 ms

915.424679487 MHz

Ref 110 dBµV/m \* Att 15 dB

1 PK  
MAXH



Center 915.4487179 MHz 1.5 MHz/ Span 15 MHz

Date: 13.NOV.2018 07:25:46

Field strength @ Horizontal Polarization-915.5MHz- PK



**MARKER 1**

915.400641 MHz

\* RBW 1 MHz

Marker 1 [T1]

VBW 10 MHz

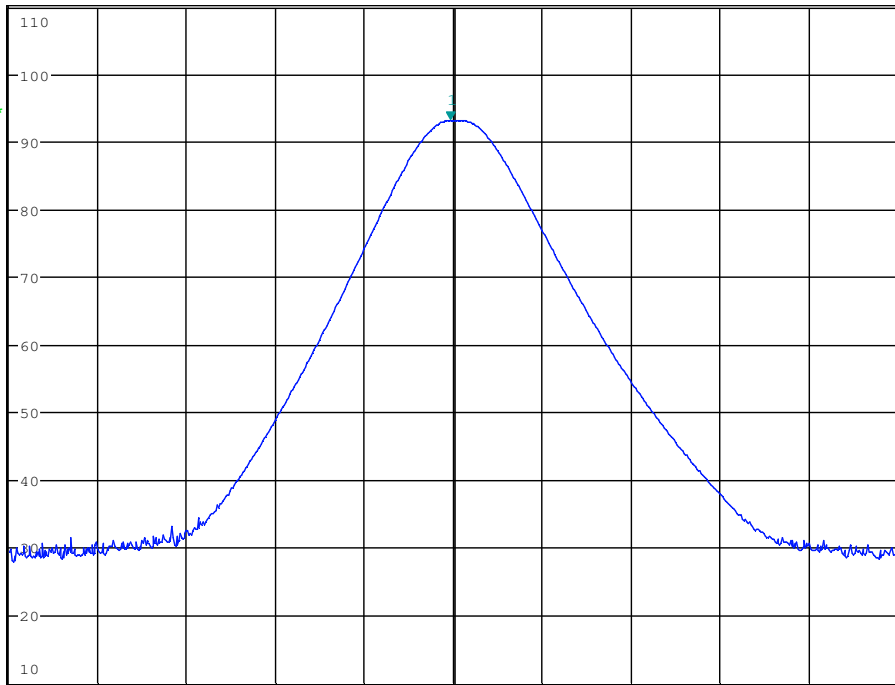
93.18 dBµV/m

SWT 2.5 ms

915.400641026 MHz

Ref 110 dBµV/m \* Att 15 dB

1 RM  
MAXH



Date: 13.NOV.2018 07:27:20

Field strength @ Horizontal Polarization-915.5MHz-rms



**MARKER 1**

915.4727564 MHz

\* RBW 1 MHz  
VBW 3 MHz  
SWT 2.5 ms

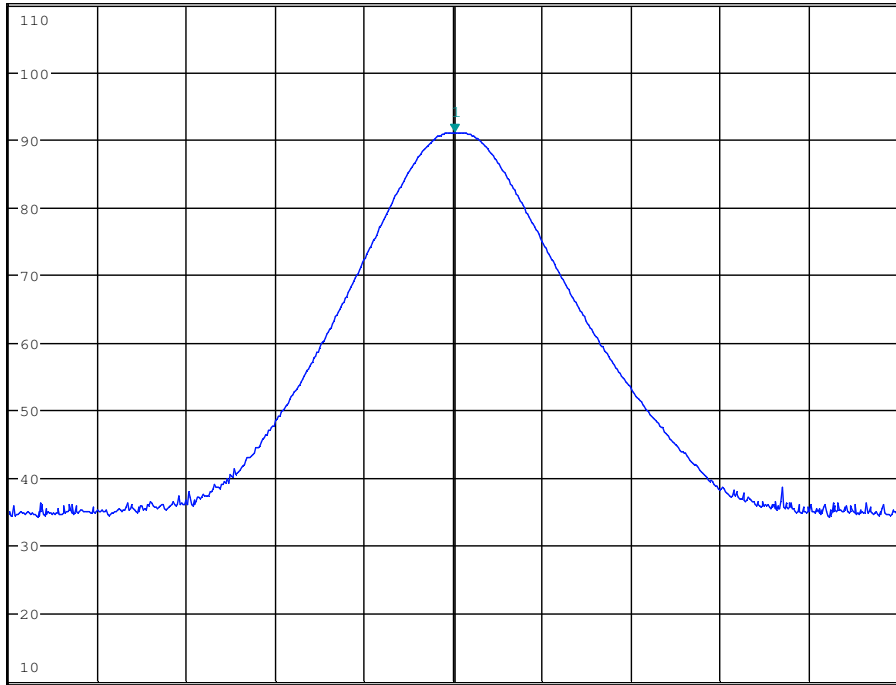
Marker 1 [T1]

91.04 dBµV/m

Ref 110 dBµV/m \* Att 15 dB

915.472756410 MHz

1 PK  
MAXH



Date: 13.NOV.2018 07:31:13

Field strength @ Vertical Polarization-915.5MHz

### 3.3 Restricted Bands of operation

Restricted Bands of operation for FCC and ISCED are defined in FCC Part 15.205 and ISCED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISCED (MHz)	FCC (GHz)	ISCED (GHz)
0.090-0.110		<b>0.96-1.24</b> <b>1.3-1.427</b>	<b>0.96-1.427</b>
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	<b>3.020-3.026</b>	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	<b>5.677-5.683</b>	2.4835-2.5	
6.215-6.218		<b>2.69-2.9</b>	<b>2.655-2.9</b>
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		<b>3.6-4.4</b>	<b>3.5-4.4</b>
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
<b>108-121.94</b> <b>123-138</b>	<b>108-138</b>	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISCED Canada, all other frequencies are common.

### 3.4 Spurious Emissions (Radiated)

FCC Part 15.209, 249 (d)

Test Results: Complies

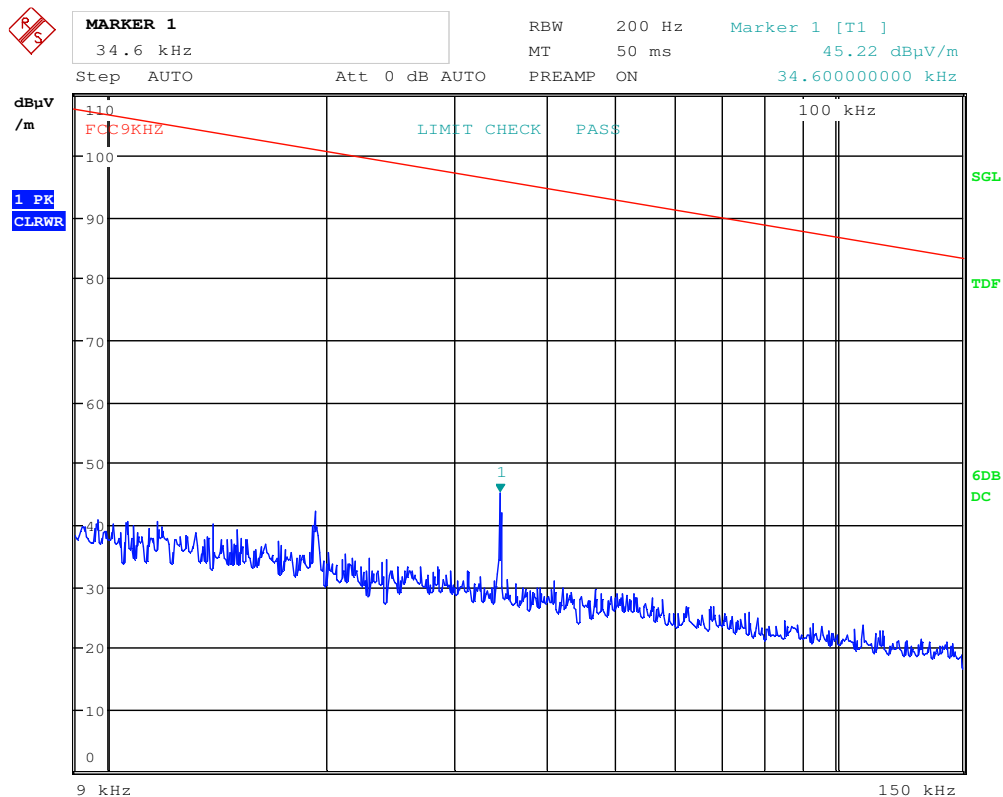
See attached plots.

**Radiated emissions 10 kHz-30 MHz.**

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached graph.

Limit is converted to 10 m using 40 dB/decade according to 15.31 (f) (2).



Date: 6.DEC.2018 06:51:50

Measured for MI receiver

**Radiated Emissions, 9 kHz – 150 kHz @10m,**  
(component at 34.6kHz is background noise, and is not from the EUT)



**MARKER 1**

166 kHz

RBW 9 kHz

Marker 1 [T1]

MT 50 ms

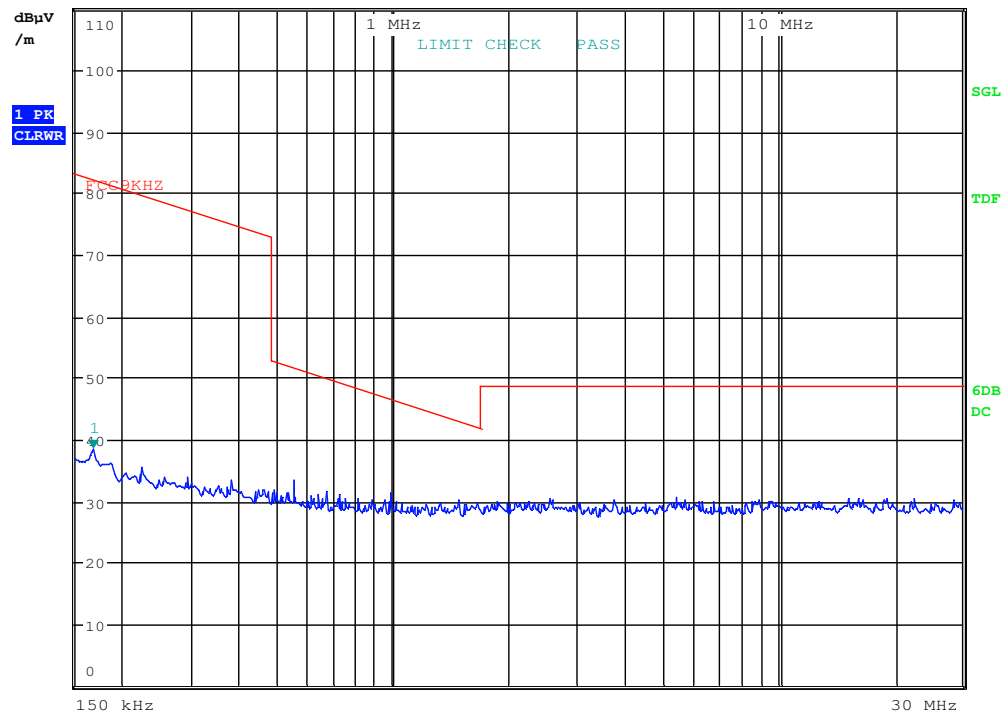
38.51 dBpV/m

Step AUTO

Att 0 dB AUTO

PREAMP ON

166.00000000 kHz



Date: 6.DEC.2018 06:59:47

Measured for MI receiver  
**Radiated Emissions, 150 kHz – 30 MHz @10m,**



## Radiated emission 30 – 1000 MHz.

Measuring distance 3 m.

Tested in speech mode with active connection.

Frequency	Operational condition	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz		dB $\mu$ V/m	metres	dB $\mu$ V/m	dB
30-902	TX on	None detected	3	40	/
928 - 1000	TX on	None detected	3	46	/

See attached graphs.

## Requirements/Limit

<b>FCC</b>	Part 15.209 @ frequencies defined in §15.205	
<b>ISED</b>	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	<b>Radiated emission limit @3 meters</b>	
<b>Frequency (MHz)</b>	<b>Quasi Peak (<math>\mu</math>V/m)</b>	<b>Quasi Peak (dB<math>\mu</math>V/m)</b>
<b>30 – 88</b>	100	40.0
<b>88 – 216</b>	150	43.5
<b>216 – 960</b>	200	46.0
<b>Above 960</b>	500	54.0

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.



**MARKER 1**

878.2435897 MHz

\*RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

22.84 dBpV/m

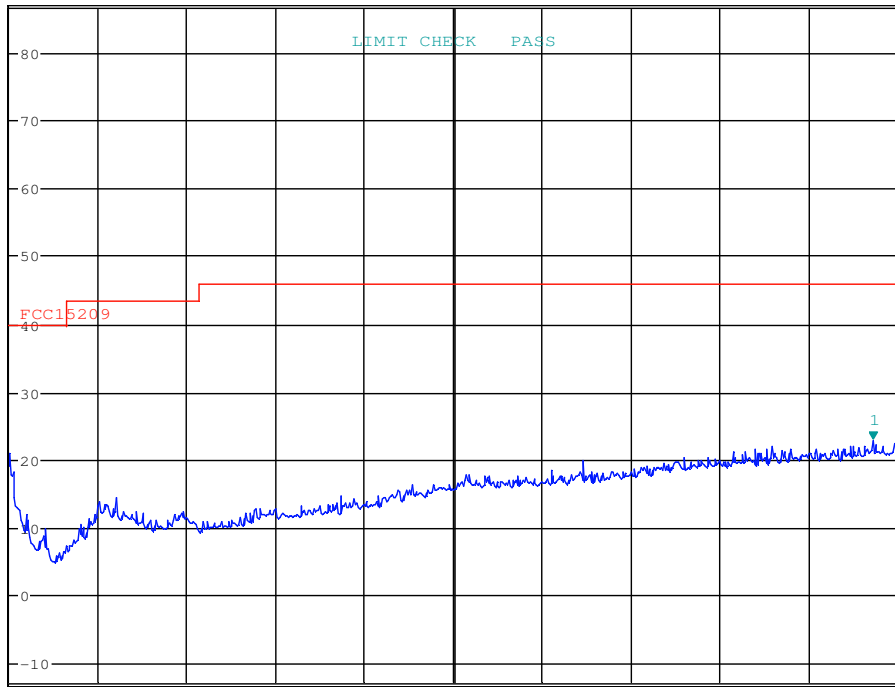
SWT 90 ms

878.243589744 MHz

Ref 87 dBpV/m

\*Att 10 dB

1 PK  
MAXH



Start 30 MHz

87.2 MHz/

Stop 902 MHz

Date: 30.OCT.2018 15:40:15

**VP: 30 - 902MHz, PK scan**



**MARKER 1**

994.1153846 MHz

\* RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

23.47 dBμV/m

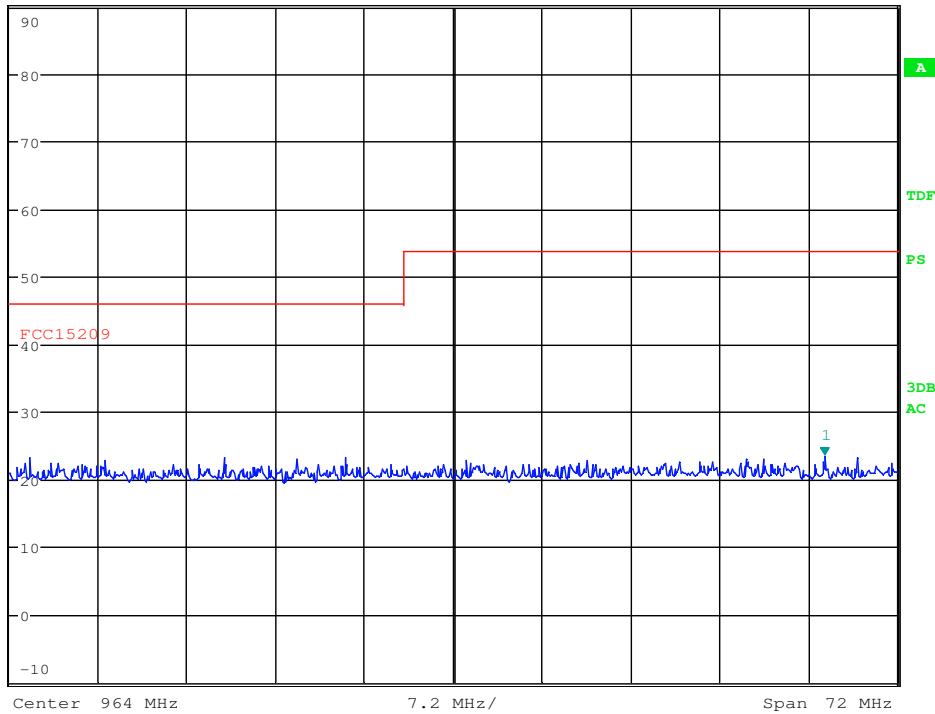
SWT 10 ms

994.115384615 MHz

Ref 90 dBμV/m

\* Att 10 dB

1 PK  
MAXH



Date: 30.OCT.2018 15:55:05

**VP: 928 - 1000MHz, PKscan**



**MARKER 2**

915.4166667 MHz

Ref 110 dBµV/m \* Att 10 dB

\* RBW 100 kHz

VBW 300 kHz

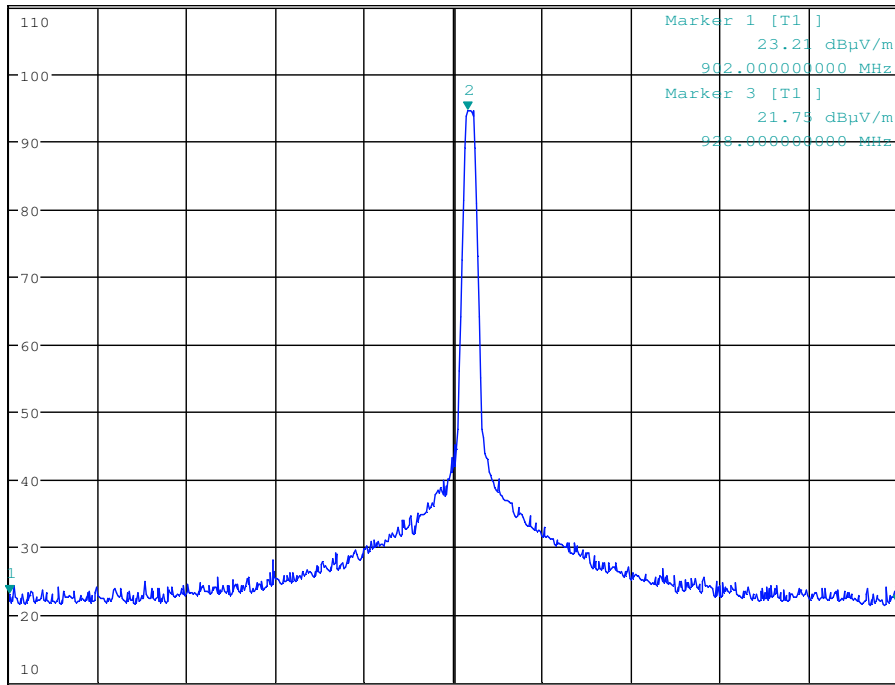
SWT 10 ms

Marker 2 [T1 ]

94.50 dBµV/m

915.416666667 MHz

1 PK  
MAXH



Start 902 MHz 2.6 MHz/ Stop 928 MHz

Date: 30.OCT.2018 15:56:19

**VP: 902 - 928MHz, PKscan, Inn band**



**MARKER 1**

886.6282051 MHz

\* RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

22.33 dBµV/m

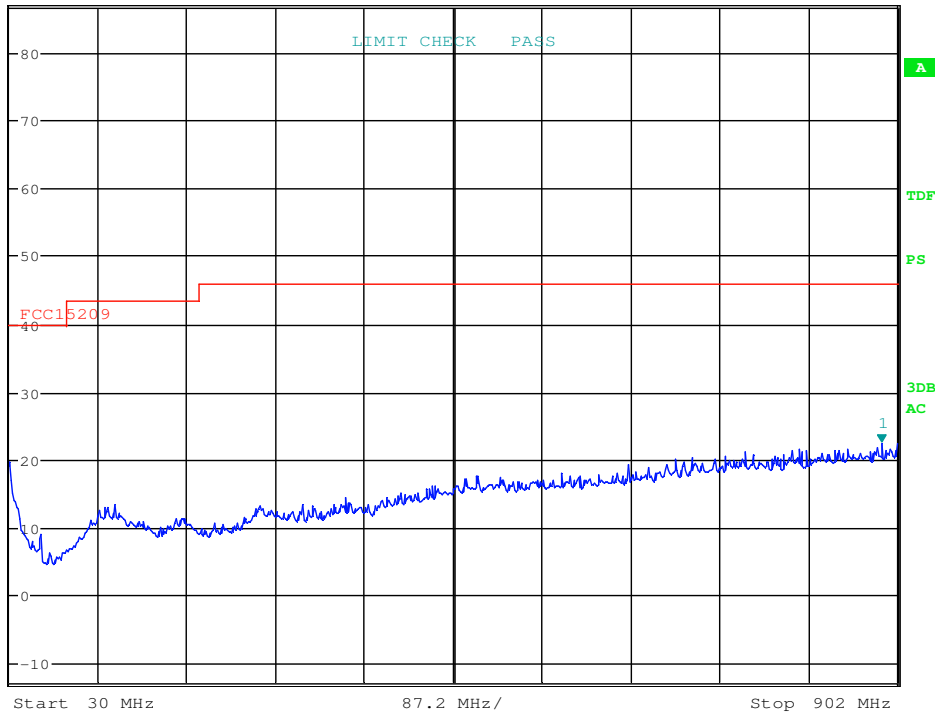
SWT 90 ms

886.628205128 MHz

Ref 87 dBµV/m

\* Att 10 dB

1 PK  
MAXH



Date: 30.OCT.2018 15:41:21

**HP: 30 - 902MHz, PKscan**



**MARKER 1**

968.3846154 MHz

\* RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

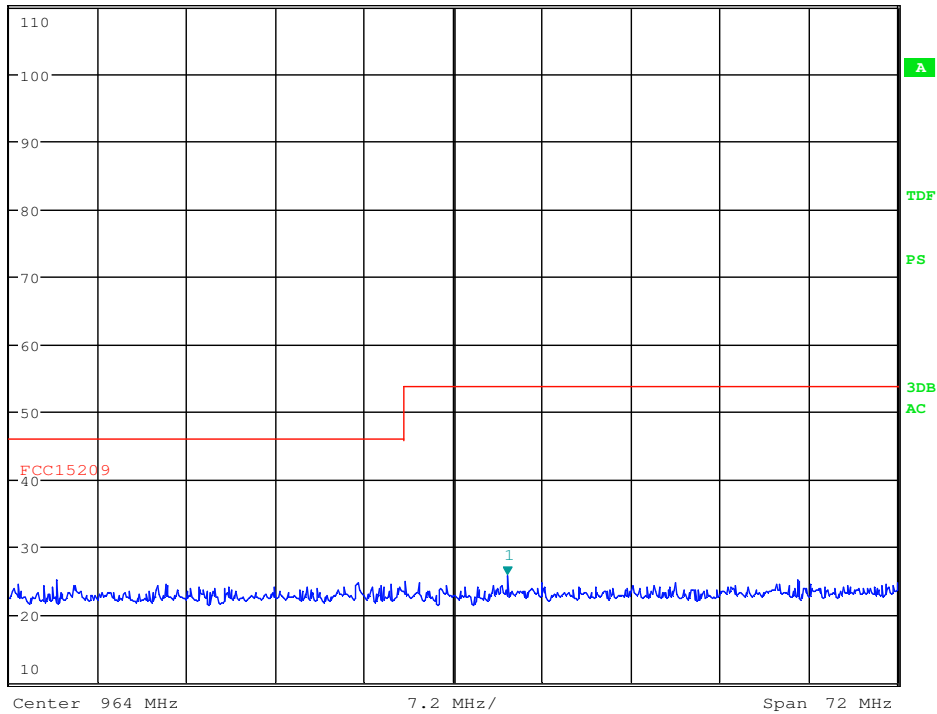
25.79 dBpV/m

SWT 10 ms

968.384615385 MHz

Ref 110 dBpV/m \* Att 10 dB

1 PK  
MAXH



Date: 30.OCT.2018 15:58:07

**HP: 928 - 1000MHz, PKscan**



**MARKER 3**

928 MHz

Ref 110 dBµV/m

\* Att 10 dB

\* RBW 100 kHz

VBW 300 kHz

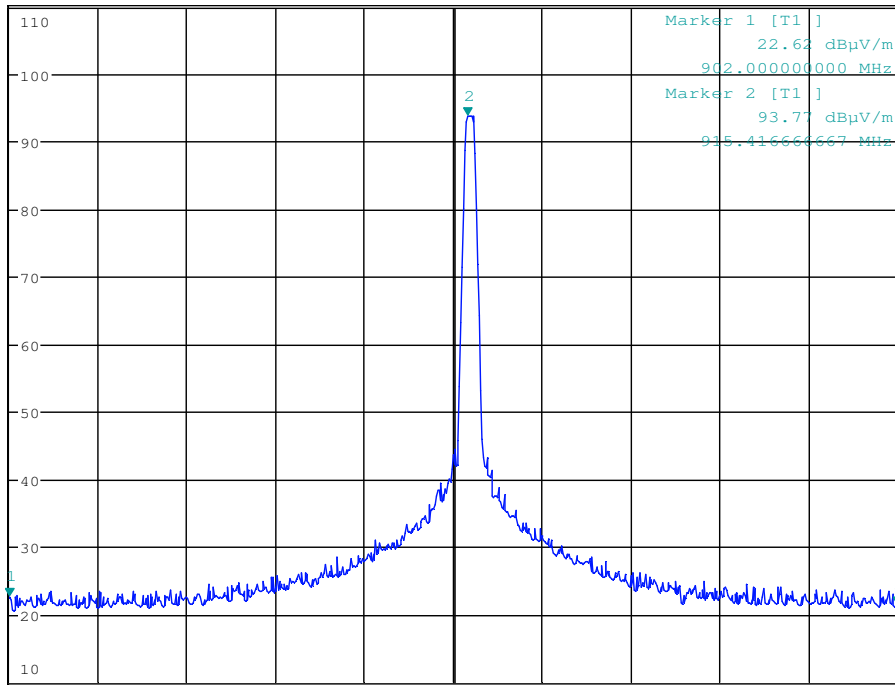
SWT 10 ms

Marker 3 [T1]

21.47 dBµV/m

928.000000000 MHz

1 PK  
MAXH



Start 902 MHz

2.6 MHz/

Stop 928 MHz

Marker 1 [T1]

22.62 dBµV/m

902.000000000 MHz

Marker 2 [T1]

93.77 dBµV/m

915.416666667 MHz

A

TDF

PS

3DB

AC

Date: 30.OCT.2018 15:57:38

**HP: 902 - 928MHz, PKscan, Inn band**

## Radiated Emissions, 1-10 GHz

Measuring distance: 3m (1 – 10 GHz)

### Peak Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
MHz	M	dB	dB $\mu$ V/m	dB	dB $\mu$ V/m	dB
2746.5	915.5MHz	0	45.78	/	74	28.2
3662.0	915.5MHz	0	54.19	/	74	19.8
4577.5	915.5MHz	0	56.64	/	74	17.4
5492.8	915.5MHz	0	57.92	/	74	16.1
Other freqs	915.5MHz	0	None detected	/	74	-

### Average Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
MHz	M	dB	dB $\mu$ V/m	dB	dB $\mu$ V/m	dB
2746.5	915.5MHz	0	-	/	54	-
3662.0	915.5MHz	0	51.12	/	54	2.9
4577.5	915.5MHz	0	53.87	/	54	0.13
5492.8	915.5MHz	0	53.01	/	54	0.99
Other freqs	915.5MHz	0	None detected	/	54	-

Average Detector values are measured.

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

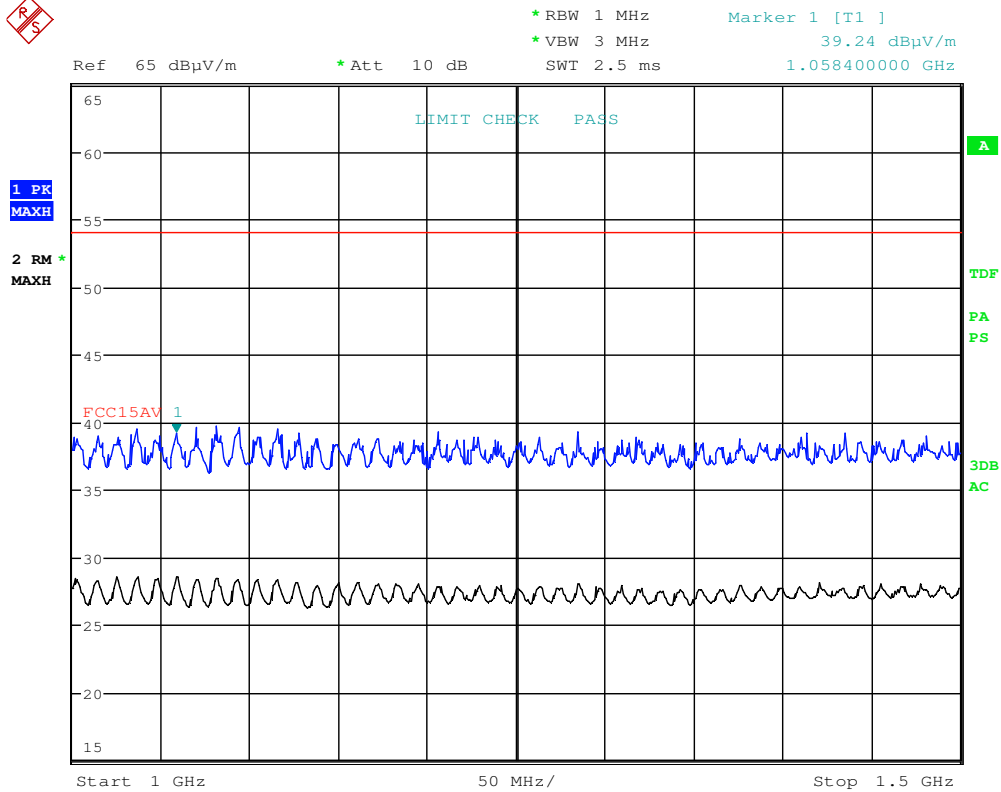
See plots.

### Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	AV (dBµV/m)	Peak (dBµV/m)
Above 1 GHz	54.0	74.0

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.





Date: 30.OCT.2018 14:21:57

VP: 1 - 1.5GHz , PK scan



**MARKER 1**

2.739583333 GHz

Ref 87 dBpV/m

\*Att 10 dB

\*RBW 1 MHz

VBW 10 MHz

SWT 50 ms

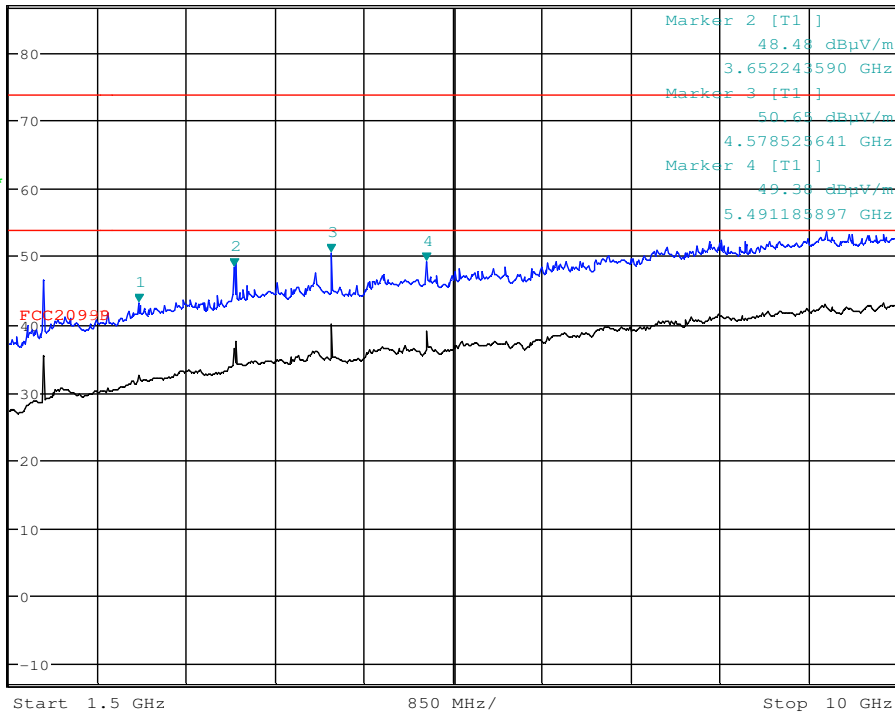
Marker 1 [T1 ]

43.29 dBpV/m

2.739583333 GHz

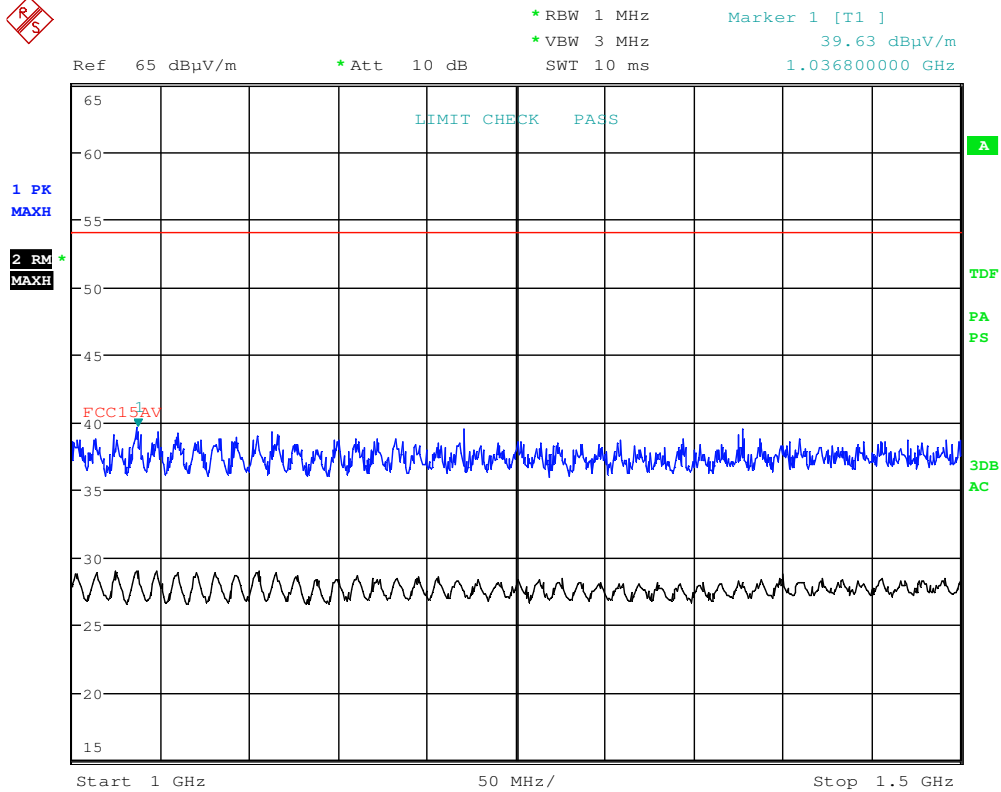
1 PK  
MAXH

2 RM  
MAXH



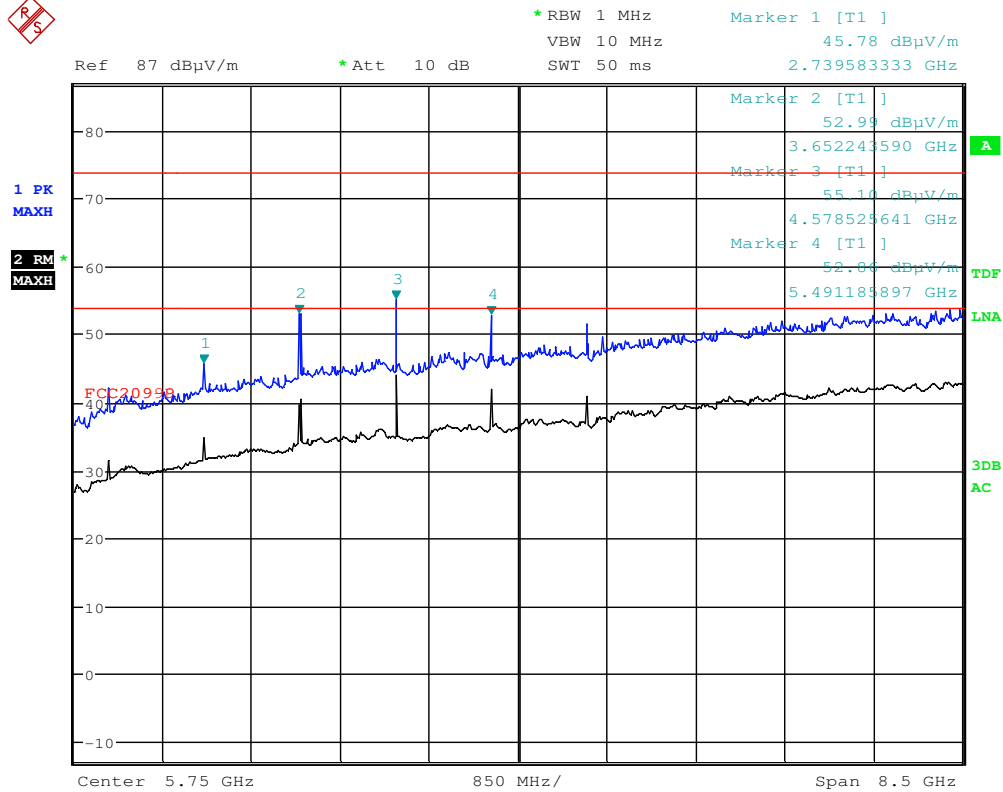
Date: 13.NOV.2018 10:25:22

**VP: 1.5 - 10GHz , PK scan**



Date: 30.OCT.2018 14:41:47

HP: 1 – 1.5GHz , PK scan



Date: 13.NOV.2018 10:22:18

HP: 1.5 - 10GHz , PK scan



**MARKER 1**

3.662 GHz

\* RBW 1 MHz

Marker 1 [T1]

VBW 3 MHz

54.19 dBpV/m

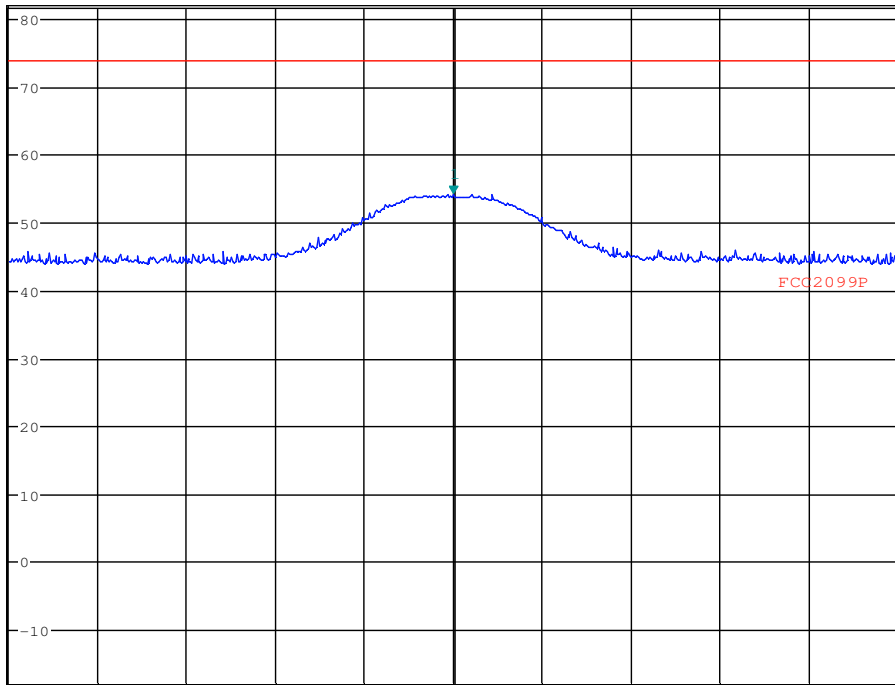
Ref 82 dBpV/m

\* Att 10 dB

SWT 20 ms

3.66200000 GHz

1 PK  
MAXH



Center 3.662 GHz

1 MHz/

Span 10 MHz

Date: 13.NOV.2018 08:39:16

**HP: 4<sup>th</sup> Harmonic, PK**



**MARKER 1**

3.66174359 GHz

Ref 82 dBμV/m

\* Att 10 dB

\* RBW 1 MHz

VBW 10 MHz

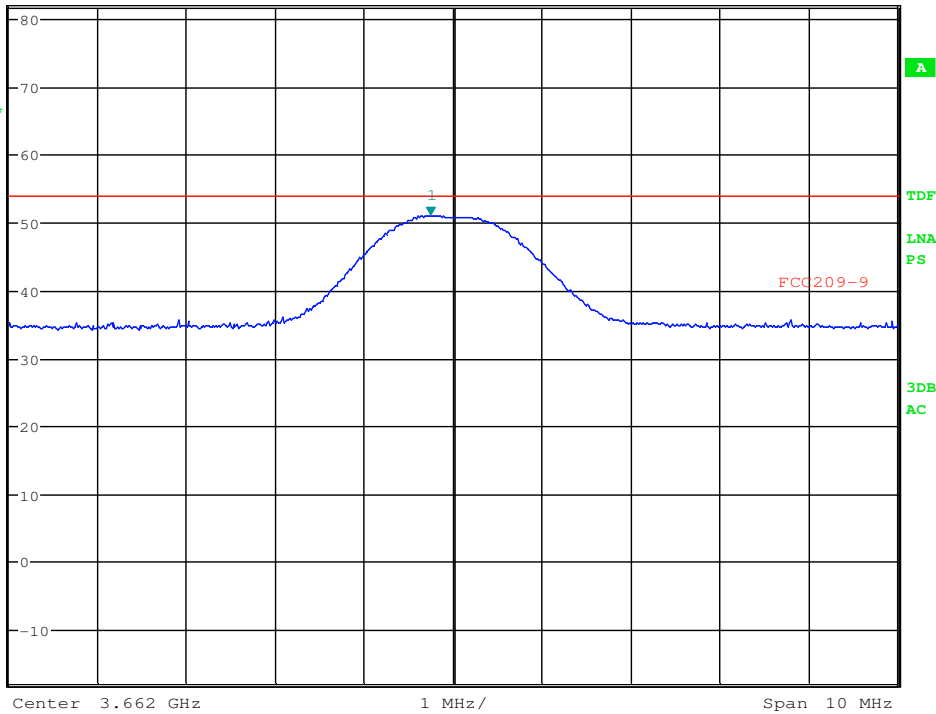
SWT 20 ms

Marker 1 [T1]

51.12 dBμV/m

3.661743590 GHz

1 RM  
MAXH



Date: 13.NOV.2018 08:40:14

**HP: 4<sup>th</sup> harmonic , rms**



**MARKER 1**

4.577564103 GHz

\* RBW 1 MHz

Marker 1 [T1]

VBW 3 MHz

56.64 dBµV/m

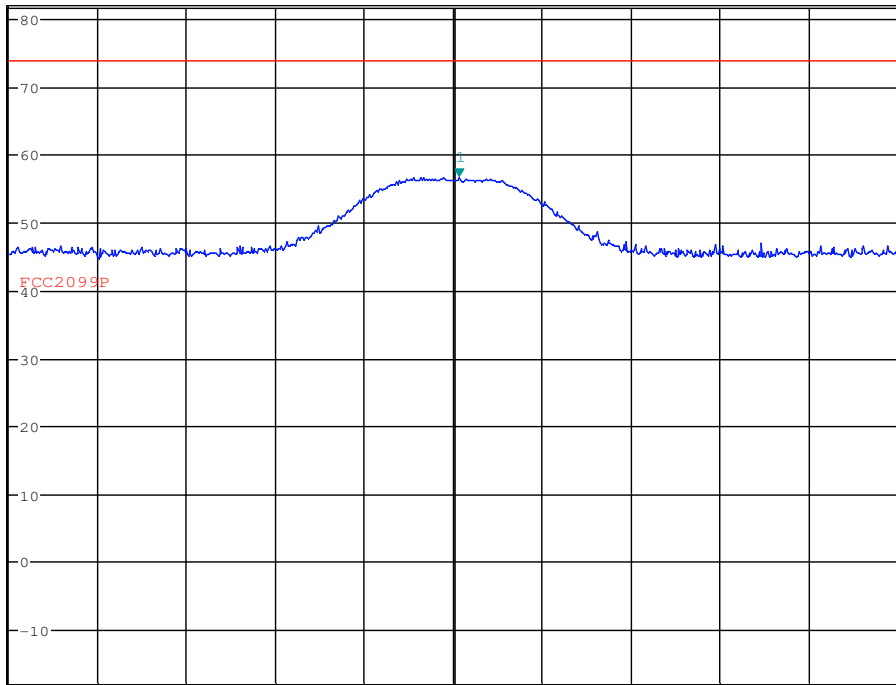
SWT 20 ms

4.577564103 GHz

Ref 82 dBµV/m

\* Att 10 dB

1 PK  
MAXH



Center 4.5775 GHz

1 MHz/

Span 10 MHz

Date: 13.NOV.2018 08:59:13

**HP: 5<sup>th</sup> harmonic, PK**



**MARKER 1**

4.57724359 GHz

\* RBW 1 MHz

Marker 1 [T1]

VBW 10 MHz

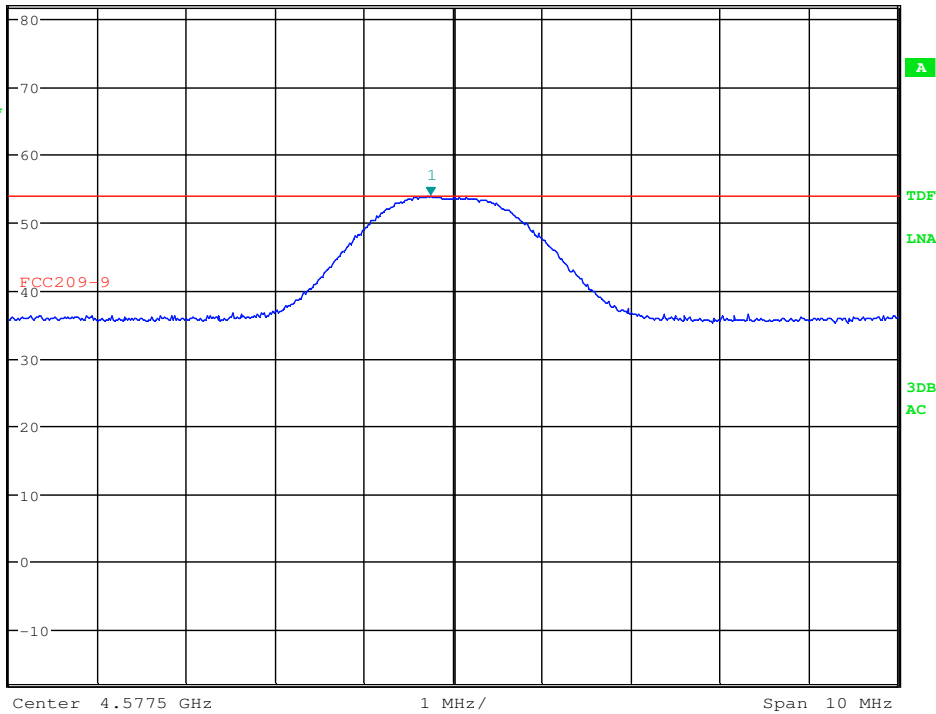
53.87 dBμV/m

Ref 82 dBμV/m \* Att 10 dB

SWT 20 ms

4.577243590 GHz

1 RM  
MAXH



Date: 13.NOV.2018 09:08:16

**HP: 5<sup>th</sup> harmonic , rms**





**MARKER 1**

5.493461538 GHz

\* RBW 1 MHz

Marker 1 [T1]

\* VBW 3 MHz

57.92 dBuV/m

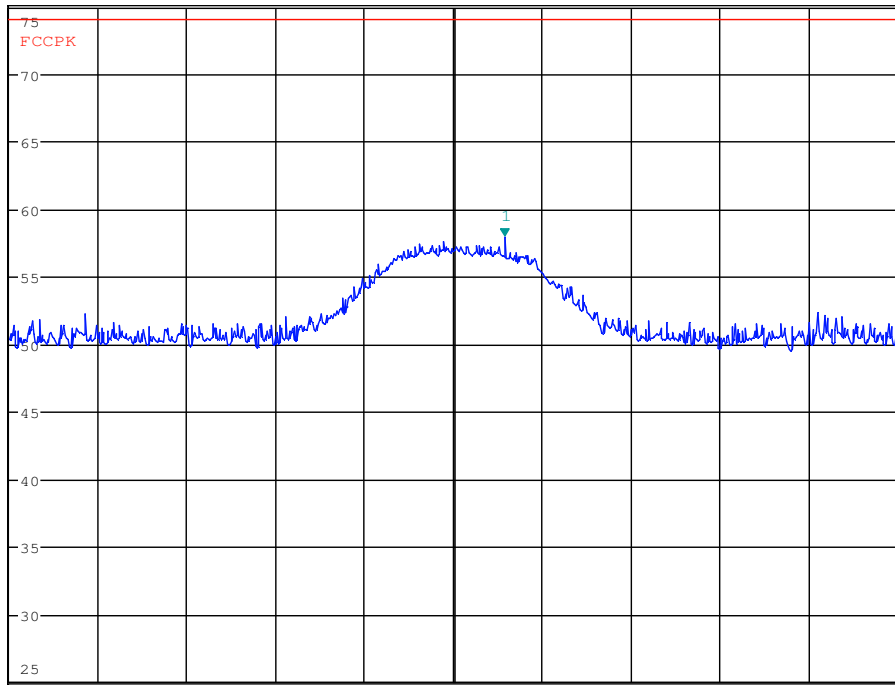
SWT 20 ms

5.493461538 GHz

Ref 75 dBuV/m

\* Att 10 dB

1 PK  
MAXH



Center 5.492884615 GHz

1 MHz/

Span 10 MHz

Date: 30.OCT.2018 15:22:57

HP: 6<sup>th</sup> harmonic, PK



**MARKER 1**

5.492836538 GHz

\* RBW 1 MHz

Marker 1 [T1]

\* VBW 3 MHz

53.01 dBpV/m

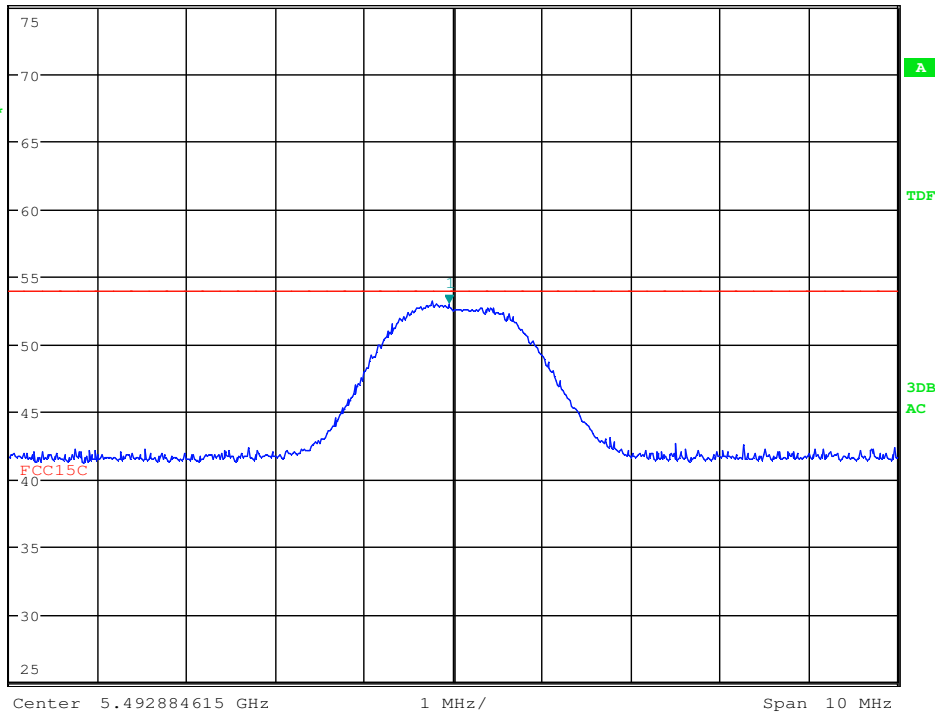
Ref 75 dBpV/m

\* Att 10 dB

SWT 20 ms

5.492836538 GHz

1 RM  
MAXH



Date: 30.OCT.2018 15:23:32

**HP: 6<sup>th</sup> harmonic , rms**

## 4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

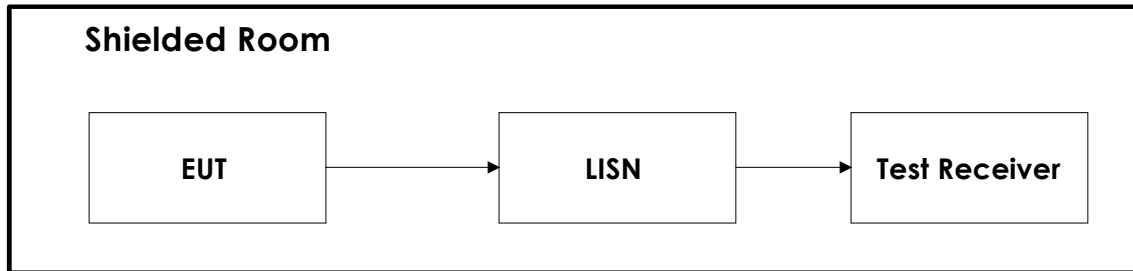
## 5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

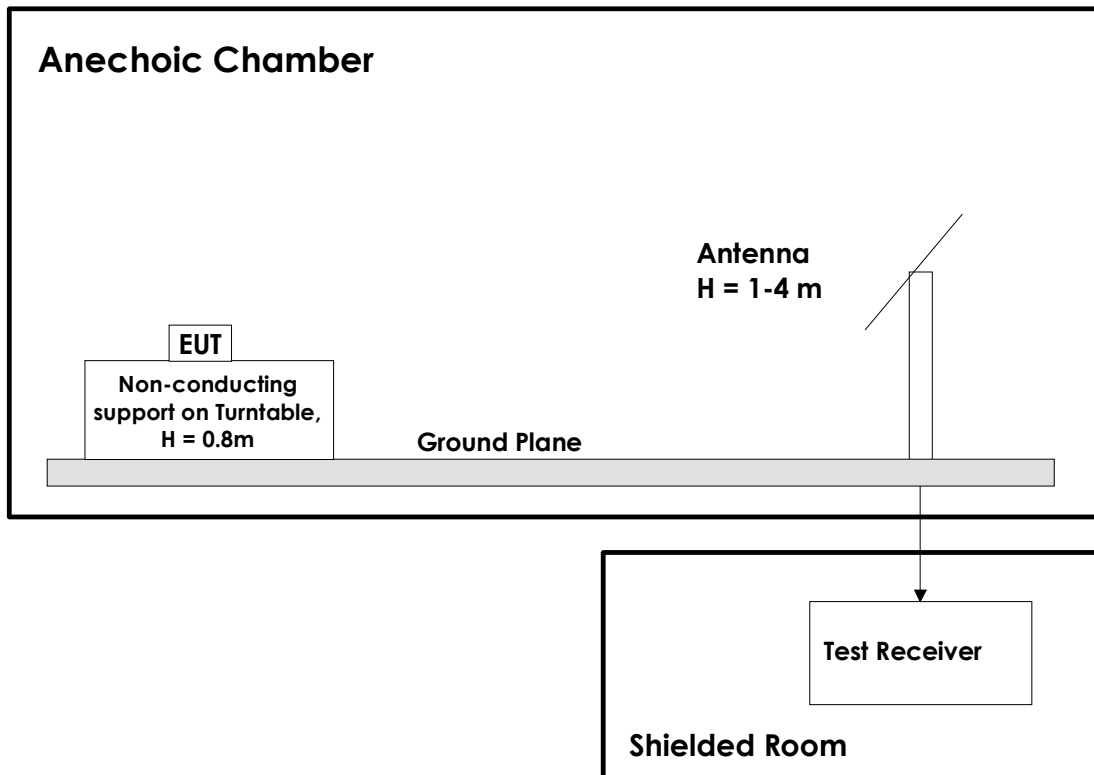
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2017.11	2019.11
2	317	Preamplifier	Sonoma	LR 1687	2018.07	2019.07
3	JB3	Biconical -log hybrid	Sunol Sciences	N-4525	2017.11	2019.11
4	FSW43	EMI receiver	Rohde & Schwarz	LR 1690	2018.01	2019.01
5	3115	Horn Antenna	EMCO	LR 1330	2016.10	2019.10
6	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2018.07	2019.07
7	6HC1500/10000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
8	Model 87V	Multimeter	Fluke	LR 1599	2018.10	2020.10
9	6810.17B	attenuator	Suhner	LR 1668	Cal b4 use	
10	/	Cable	Rosenberger	LR 1627	Cal b4 use	

## 6 BLOCK DIAGRAM

### 6.1 Power Line Conducted Emission



### 6.2 Test Site Radiated Emission



Measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.