National Centre for Radio Astrophysics

Internal Technical Report

GMRT/RFI/1 – 27th October 2020

Report on RFI measurement of Panasonic make IP phone

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Revision	Date	Modification/ Change
Ver. 1	27th October. 2020	First Version

Objective:

To find out radio frequency interference coming from the **Panasonic make IP phone**.

(Model No. KX-HDV130)

Key Features:

- 2-line SIP Phone
- Full-Duplex Speaker Phone
- Supports Two SIP Accounts
- High-definition Audio (G.722)
- Designed for Use with Preferred SIP Service Providers
- Dual LAN Ports

Specifications:

Display	
LCD Display	Monochrome Graphical
LCD Size	132 × 64 pixel 2.3 inch Graphical LCD
LCD Contrast	6 levels
LCD Backlight	On/Auto/Off
Install Options	
Desk Mount Tilt	Yes – 2 positions
Wall Mount	KX-A440 (optional)
Power Adaptor	KX-A423 (optional)
Audio Features	
Handset, Speaker, Headset Volume	8 levels (includes echo cancellation and distortion prevention)
Ringtones	27
Ringer Volume	8 levels + Off
Headset Port	RJ9 jack
Electronic Hook Switch Control Port	-
Audio Codec	G.711a-law / G.711μ-law / G.722 (wideband) / G.729a
HD Voice	Yes
Speaker Phone	Yes
Keys	
Programmable Keys	2
Software Features	
Phone Book (Local)	500
LDAP Remote Phonebook	Yes
XML Remote Phonebook	Yes
Call Log Entries	30 incoming calls + 30 outgoing calls
Conferencing	3 parties (within terminal – multi-party dependent on server)
XML Application	Yes
Music on Hold	Supplied by Host Service (PBX / SIP Server)
IP Features	
SIP Accounts	2
SIP Compatibility	RFC 3261 Standard SIP Server, Asterisk, Broadsoft, Panasonic IP PBX
IP Version	IPv6 / IPv4
DHCP Client	Yes
DNS	Yes
HTTP	Yes
HTTPS	Yes
SNTP Client	Yes
VLAN (802.1q)	Yes
QoS (DiffServ)	Yes

Test setup:

1. Measurement is done at 3 meter distance with LPDA antenna used as a receiving antenna at Multi-Purpose Building location (MPB).
2. LPDA Antenna is connected with 20dB post-amplifier.
3. Measurement is done in the horizontal and vertical polarization mode with various test conditions as follows.
    a) Phone powered (ON) with external DC (+5V) power supply.
    b) Phone ON with Ethernet cable connected to device at one end and other end connected to Ethernet switch outside the shielded lab.
    c) Phone ON in calling mode (Another phone kept outside the shielded lab connected via Ethernet cable thru network switch)
4. Measurement frequency range: 30MHz to 2 GHz frequency range.

Measurement Results:

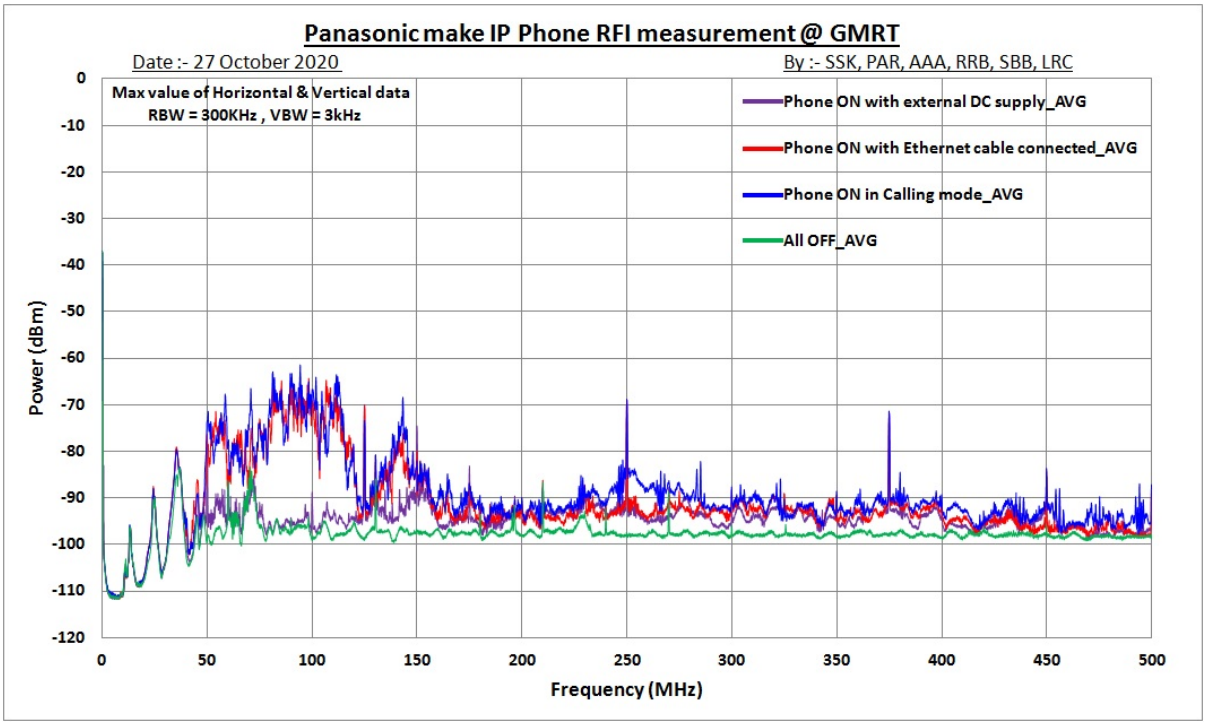

Fig.1:- Max Value of all data for Horizontal & Vertical polarization in the Frequency band 0-500MHz.

1. **Violet line** shows broad band RF noise 1-14dB above the noise floor level when Phone powered (ON) with external DC (+5V) power supply in trace Average mode.
2. **Red line** shows broad band RF noise 1-35dB above the noise floor level when Phone ON with Ethernet cable connected to device at one end and other end connected to Ethernet switch outside the shielded lab in trace Average mode.
3. **Dark blue line** shows broad band RF noise 1-35dB above the noise floor level when Phone ON in calling mode (Another phone kept outside the shielded lab) in trace Average mode.
4. **Green line** shows the ambient noise floor level in All OFF with trace Average mode.

Note: - The periodic lines have been observed at the interval of 125MHz in the frequency band from 0-2000MHz for all test conditions.

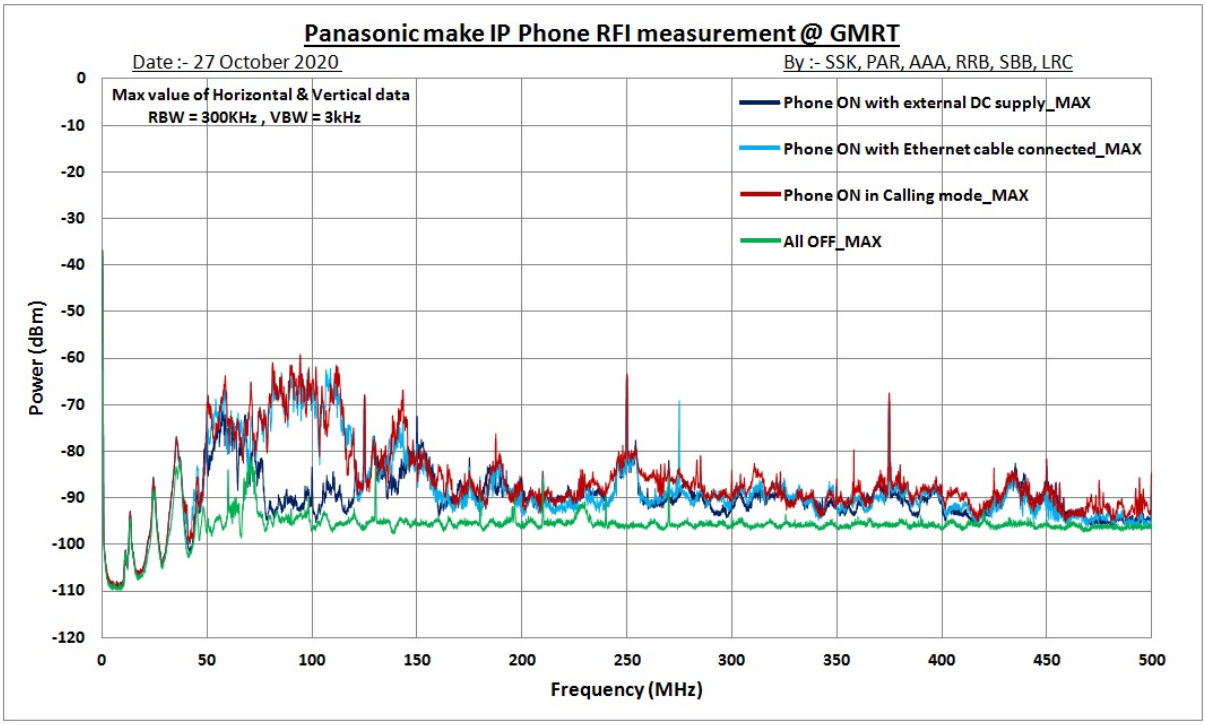

Fig.2:- Max Value of all data for Horizontal & Vertical polarization in the Frequency band 0-500MHz.

1. **Navy blue line** shows broad band RF noise 1-20dB above the noise floor level when Phone powered (ON) with external DC (+5V) power supply in trace Maxhold mode.
2. **Sky Blue line** shows broad band RF noise 1-38dB above the noise floor level when Phone ON with Ethernet cable connected to device at one end and other end connected to Ethernet switch outside the shielded lab in trace Maxhold mode.
3. **Brown line** shows broad band RF noise 1-38dB above the noise floor level when Phone ON in calling mode (Another phone kept outside the shielded lab) in trace Maxhold mode.
4. **Green line** shows the ambient noise floor level in All OFF with trace Maxhold mode.

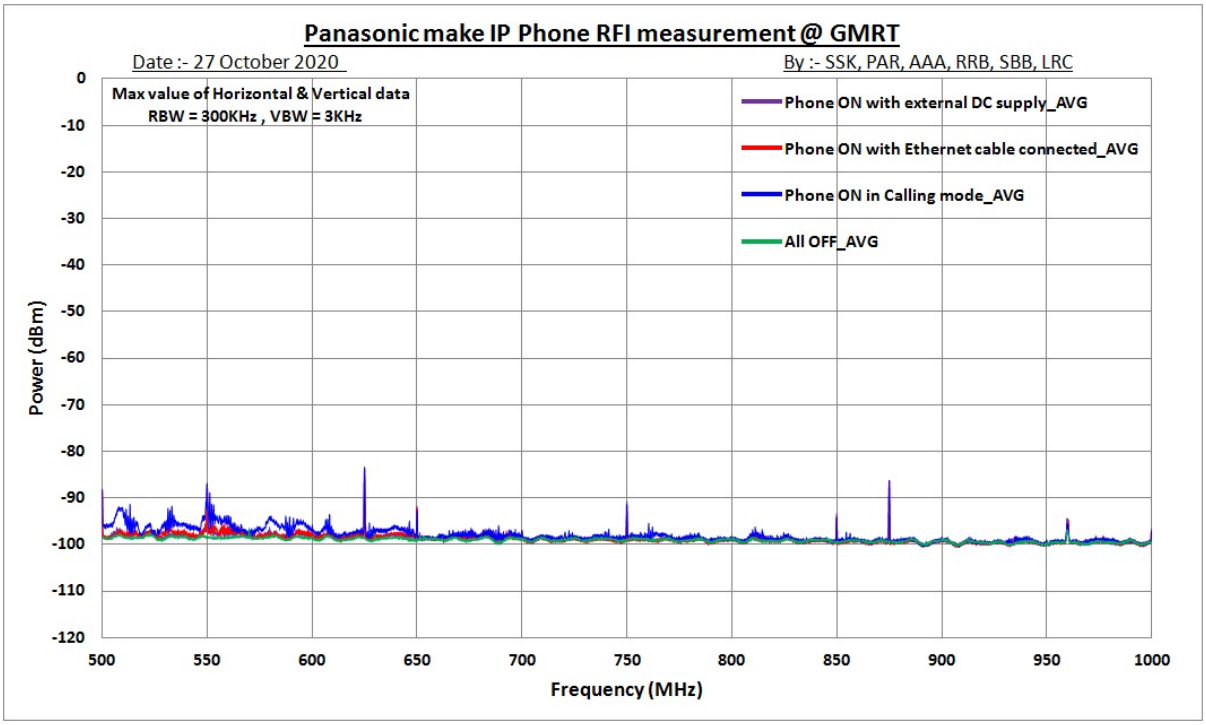

Fig.3:- Max Value of all data for Horizontal & Vertical polarization in the Frequency band 500-1000MHz.

1. **Violet line** shows broad band RF noise 1-3dB above the noise floor level when Phone powered (ON) with external DC (+5V) power supply in trace Average mode.
2. **Red line** shows broad band RF noise 1-3dB above the noise floor level when Phone ON with Ethernet cable connected to device at one end and other end connected to Ethernet switch outside the shielded lab in trace Average mode.
3. **Dark blue line** shows broad band RF noise 1-8dB above the noise floor level when Phone ON in calling mode (Another phone kept outside the shielded lab) in trace Average mode.
4. **Green line** shows the ambient noise floor level in All OFF with trace Average mode.

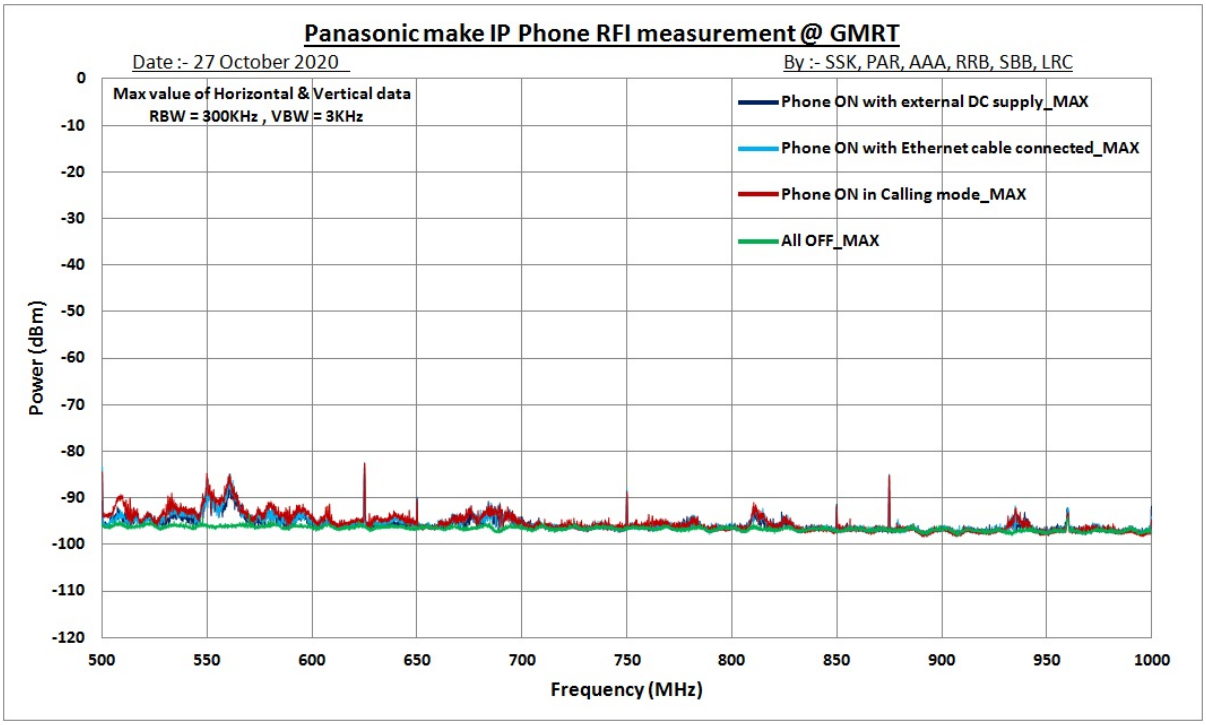

Fig.4:- Max Value of all data for Horizontal & Vertical polarization in the Frequency band 500-1000MHz.

1. **Navy blue line** shows broad band RF noise 1-10dB above the noise floor level when Phone powered (ON) with external DC (+5V) power supply in trace Maxhold mode.
2. **Sky Blue line** shows broad band RF noise 1-10dB above the noise floor level when Phone ON with Ethernet cable connected to device at one end and other end connected to Ethernet switch outside the shielded lab in trace Maxhold mode.
3. **Brown line** shows broad band RF noise 1-12dB above the noise floor level when Phone ON in calling mode (Another phone kept outside the shielded lab) in trace Maxhold mode.
4. **Green line** shows the ambient noise floor level in All OFF with trace Maxhold mode.

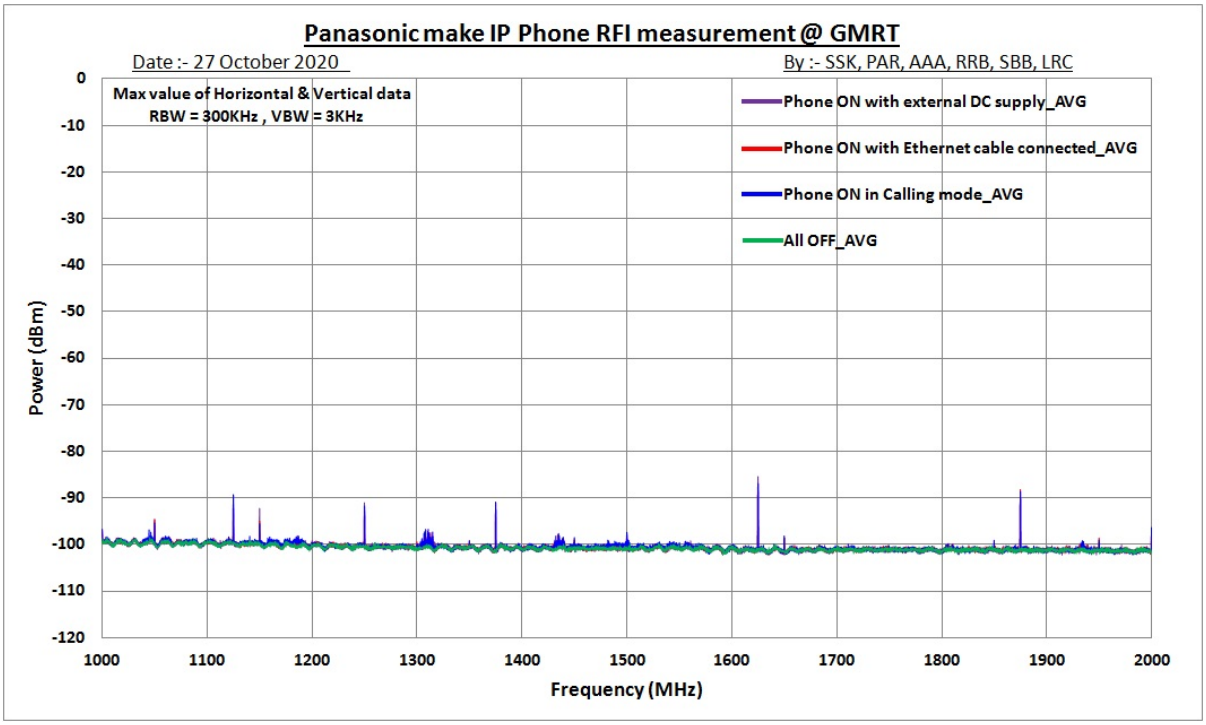

Fig.5:- Max Value of all data for Horizontal & Vertical polarization in the Frequency band 1000-2000MHz.

1. **Violet line** shows broad band RF noise 1-2dB above the noise floor level when Phone powered (ON) with external DC (+5V) power supply in trace Average mode.
2. **Red line** shows broad band RF noise 1-2dB above the noise floor level when Phone ON with Ethernet cable connected to device at one end and other end connected to Ethernet switch outside the shielded lab in trace Average mode.
3. **Dark blue line** shows broad band RF noise 1-3dB above the noise floor level when Phone ON in calling mode (Another phone kept outside the shielded lab) in trace Average mode.
4. **Green line** shows the ambient noise floor level in All OFF with trace Average mode.

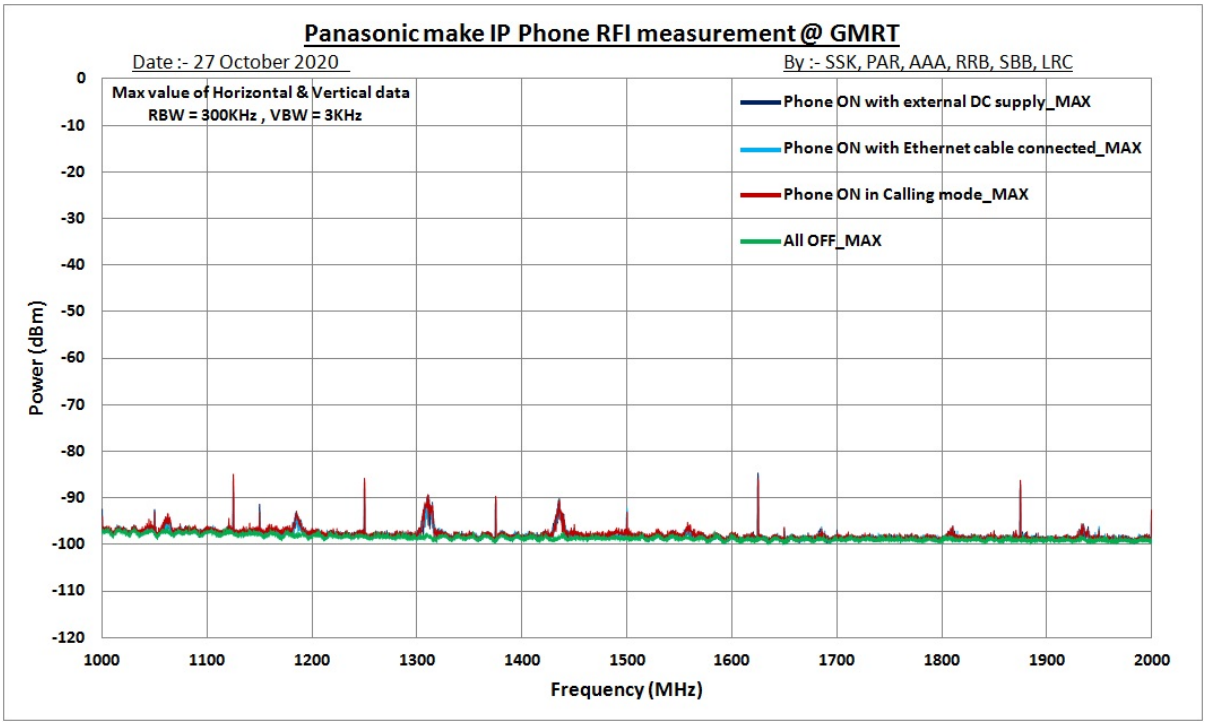

Fig.6:- Max Value of all data for Horizontal & Vertical polarization in the Frequency band 1000-2000MHz.

1. **Navy blue line** shows broad band RF noise 1-3dB above the noise floor level when Phone powered (ON) with external DC (+5V) power supply in trace Maxhold mode.
2. **Sky Blue line** shows broad band RF noise 1-3dB above the noise floor level when Phone ON with Ethernet cable connected to device at one end and other end connected to Ethernet switch outside the shielded lab in trace Maxhold mode.
3. **Brown line** shows broad band RF noise 1-5dB above the noise floor level when Phone ON in calling mode (Another phone kept outside the shielded lab) in trace Maxhold mode.
4. **Green line** shows the ambient noise floor level in All OFF with trace Maxhold mode.

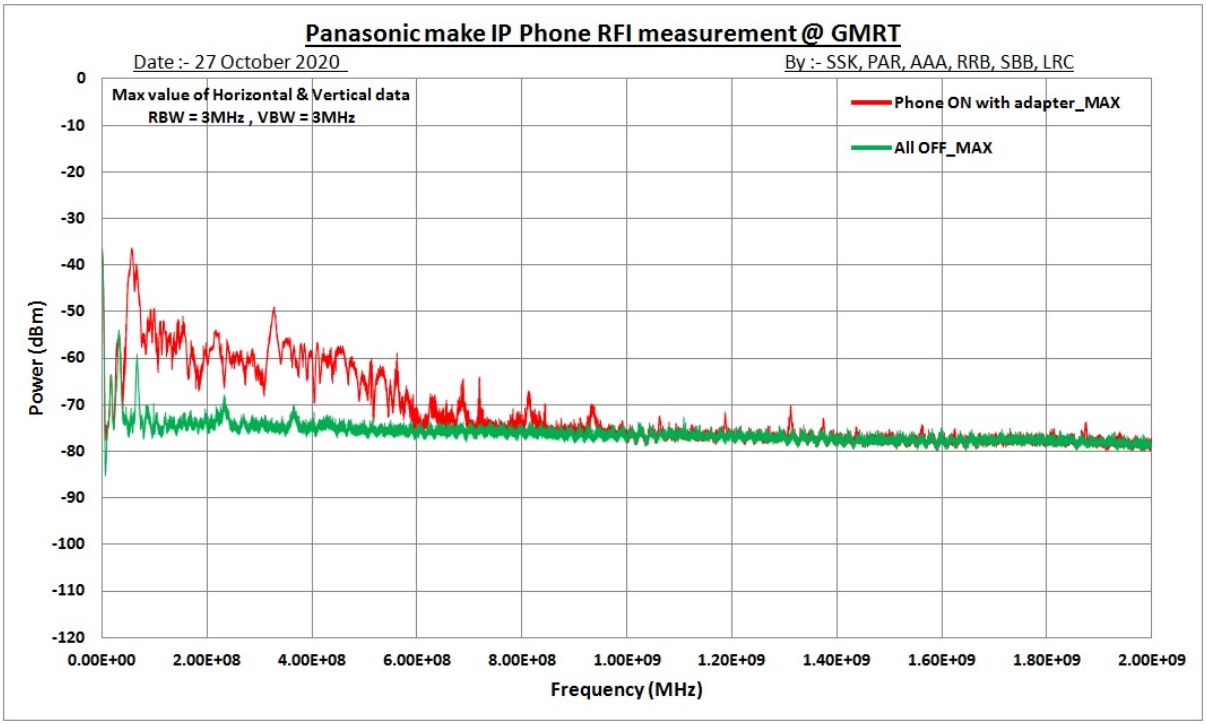

Fig.7:- Max Value of all data for Horizontal & Vertical polarization in the Frequency band 0-2000MHz.

1. **Red line** shows broad band RF noise 1-42dB above the noise floor level in 0-2000MHz frequency band when Phone ON with DC adapter (+5V) in trace Maxhold mode.
2. **Green line** shows the ambient noise floor level in the All OFF condition with trace in Maxhold mode.

Images:

Image1&2: Panasonic make IP Phone Model No. KX-HDV130 (Front & Rear View)

Conclusion:-

Maximum Broad band and Periodic Radio frequency emission generated by the IP Phone above ambient noise floor level (All OFF condition) is tabulated as follows.

Frequency (MHz)	Broad Band RF Noise Level (dB)		Periodic Lines level spaced at 125MHz (dB)
	AVG	MAX	
0-500 MHz	1-35	1-38	1-30
500-1000 MHz	1-8	1-12	1-15
1000-2000 MHz	1-3	1-5	1-18

Table1: Maximum values of all Average and Maxhold data (LPDA Horizontal & Vertical polarization).

The **Panasonic make IP phone (Model No. KX-HDV130)** produces broad band radio frequency emission (RFI) 1-38dB above the ambient noise floor level (all OFF mode) in the frequency band from 30-2000MHz for all test conditions and hence may not be a suitable option to be used inside the GMRT premises without shielding solution.

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